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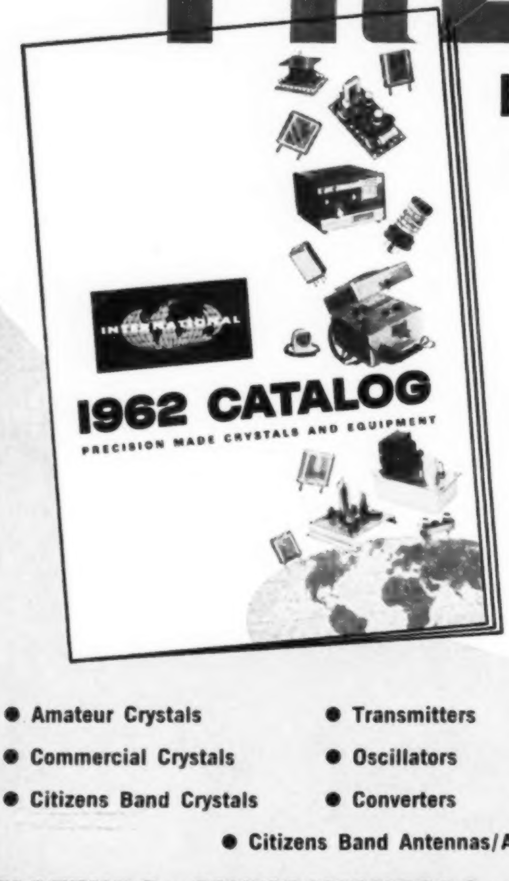

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Now you, too, can learn to talk steadily to keep the rig on the air.
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. . . de W2NSD

. . . never say die

Columns

We have, so far, been able to keep successfully away from running any regular monthly columns. The thinking behind this, as you probably know, is that while most columns start out to be very interesting, after a while the authors run out of ideas and things get pretty dull. Of course there are several general types of columns that are presently available elsewhere . . . there is the operating news type thing where you can look up and see what has happened in your own special interest of late. One drawback of this type of reporting is the two months delay in getting the news in print that is part and parcel of publishing a monthly magazine. By the time you read about a DXpedition it is all over, etc.

A second type is the "listing of calls" style of column which attempts to get as many calls in print as possible on the premise that people like to see themselves in print. Unfortunately this makes terribly dull reading for everyone else. A third (very rare) type of column is that devoted to technical matters. Something like this would be printed in 73, were it to be submitted as individual articles.

Then along comes something like this Ham-TV, which has quite a need for a lot of communication between the interested parties. A monthly column would be a big help for the fellows getting on TV. But, again, it would be pretty dull stuff for all the other readers. The obvious answer to this is a monthly bulletin. Something like this can be printed inexpensively and fast, getting the information out in a matter of days instead of months. We could provide an eight page monthly (six to twelve a year) bulletin to all subscribers to 73 who pay one extra dollar per year. Since we are so well set up for producing things like that I think we could split the dollar with whoever was editing the bulletin, giving him a little incentive. While this wouldn't amount to much over $500 to $1000 a year, it still isn't a bad deal for a part time project.

We are all set for the Ham-TV bulletin, I believe. Mel Shadbolt, the author of our Ham-TV Manual, has been so swamped with requests for information on who is getting on where and with what that he has offered to take on the job of turning out a bi-monthly bulletin for the TV-ites.

This still leaves several other special interests that could well use some better communications. The moonbouncers and other UHF'ers sure do need some coordinating. I haven't seen anything national in the way of a traffic bulletin, but then maybe there aren't enough fellows interested in having one. There used to be a fine RTTY bulletin, but I haven't seen one of those for over a year now, which leaves another field wide open. The DX Bulletin by Don Chesser is doing a fine job, but perhaps there is a need for a lower cost monthly bulletin in this field. You can probably think up a lot more that would serve a useful purpose.

If you are seriously interested in editing a monthly bulletin for some special interest and you have the experience to know what you are talking about in that field, then maybe we can get together. We can shoulder the entire cost of printing and mailing the bulletins if you can provide us with the manuscript all set to be printed each month on a fixed immutable schedule. We can advertise the bulletin in 73 and charge one dollar per year for it, sending you one half of the receipts as your payment. Sure, we'll lose money on the deal, but it'll be a valuable service and it will be worth it. If all this sounds reasonable and you want to sign over your soul to the publishing field, then drop a line.

Navassa Island

Back in 1958 a group of us got together and had a little DXpedition to Navassa Island, using the call KC4AF. This was probably one of the most successful DXpeditions in history,

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April 8—What computers can do.

April 15—Latest trends in military type transistors.

April 22—Transistorized citizens band transceivers.

April 29—Use of transistors as high power amplifiers and oscillators.

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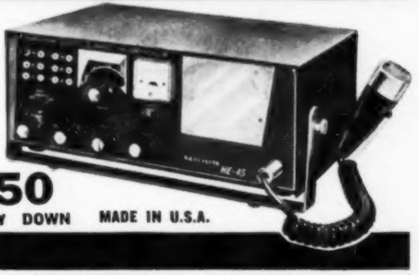

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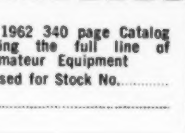

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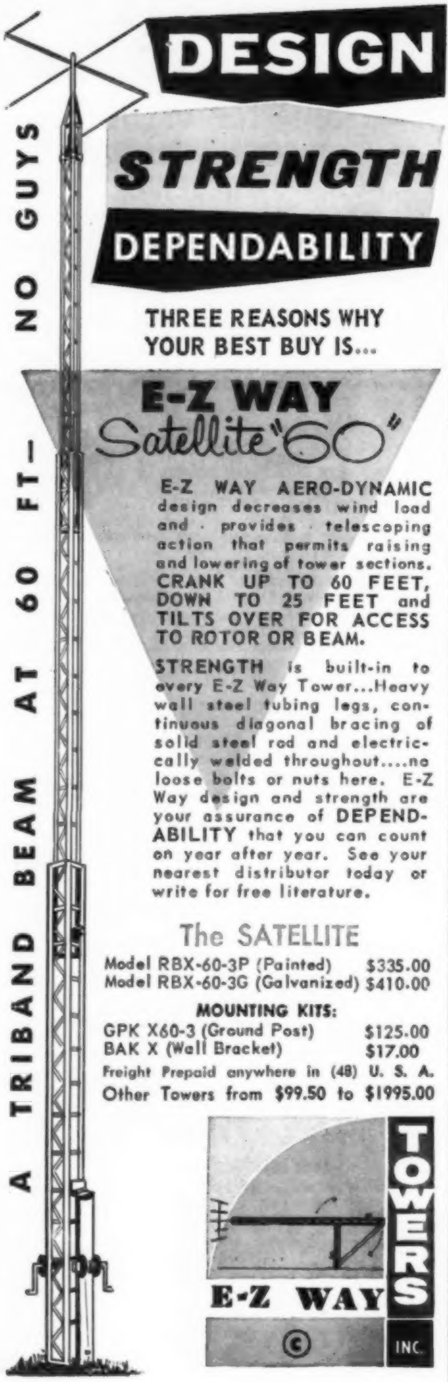
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When I left CQ Magazine back in January 1960 my entire collection of slides of the Navassa trip were on loan to a radio club, along with a tape recorded commentary. These were returned to CQ later and I have so far been unable to get them back. I would like to be able to again enjoy the slides of this trip and perhaps be able to show them at occasional ham clubs and conventions. They are good and they are interesting. Perhaps if you would help me in this matter we could influence the Publisher: S. R. Cowan, the Acting Publisher: Richard Cowan, or the Production Manager: Cary Cowan, that it would be the fair thing to return these slides. If you just drop any of them a QSL card with a note at 300 West 43rd Street, New York 36, we might get some action.

How To Help

Many subscribers have written in to ask what they can do to help boost 73. There are two necessary ingredients to the success of 73: readers and advertisers. Anything you can do to help with either of these departments will be greatly appreciated and will result in a bigger and even better magazine. There sure is a lot yet to be done in both of these directions.

In the readership end of things there are few fellows who have not by now at least heard about 73. There are still a lot that are not subscribing. This can be attended to at your club meetings (we have special subscription rates for five or more received at once: 50¢ off on each subscription) where the subject can be broached regularly until resistance wears down and the pinch-penny members part with their worn faded dollar bills. Many articles in 73 make fine discussion on the air and who knows, you might convert someone from Brand X. With a little persistence you can easily brainwash several unsuspecting fellows a day.

You might keep a sharp eye on the advertisers and encourage new companies with re-

(Turn to page 86)

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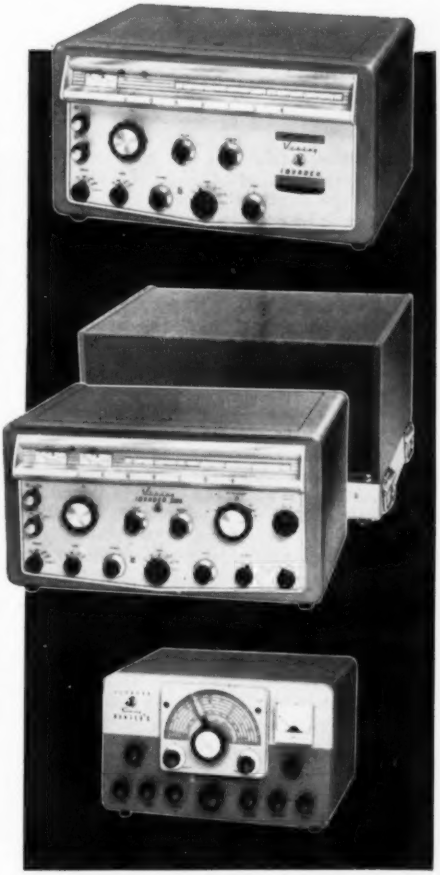

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Six Meter SSB Exciter/Transmitter

Capt. John J. Sury W5JSN/K8NIC
139 Nebraska Road
Dyess AFB, Texas

Photos by Ben Head K5HWF

HAVE you been thinking of getting on sideband on six, but financially it almost seemed impossible. Now is your chance—especially the Technician who probably does not own a HF sideband exciter—to go with a transverter. Quite an investment is involved in our modern exciters available on the amateur market.

The author feels that the exciter presented here is the minimum he could construct as for cost, but the effort is a little bit more. During the design and construction stages, several of the circuits have been modified or remodified at least a dozen times. It is about the most simplest that could be built and still give good quality sideband, either upper or lower.

Most builders have quite an assortment of junk—resistors, capacitors, tubes, transformers, etc.—and from this assortment plus the bargain basement electronic parts this exciter can be fabricated. The most expensive item in the exciter is the B&W type 2Q4 model number 350 plug in phase shift net. The other larger items are the 2E26 or a 6146 if you desire it, 1:3 step up transformer, and two universal audio output transformers rated at 4 watts each.

Since the 6 meter band is dead in this part of the country only local checks could be made. The exciter was complimented in every case. Its output is approximately 5 watts PEP using a 300 volt 200 ma. power supply.

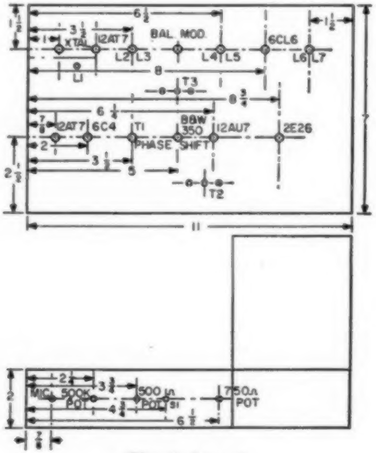
In this article a suggested lay-out is presented. The author used it with success, but it is not what could be called beautiful. This was strictly an experimental model.

No hetrodyning is done in this exciter. It is strictly a straight thru type. Starting with an 8 mc. rock, using the third overtone and doubling it into the balanced modulators. (Refer to block diagram.) The balanced modulator was constructed in a plug in the eight pin octal accessory case. Refer to sketch for pins that the 1N34's are soldered to. This method was used because of the natural shielding and that various types of diodes could be tried without disturbing the other wiring. The bargain 10 for $1.00 diodes were tried and they worked fine.

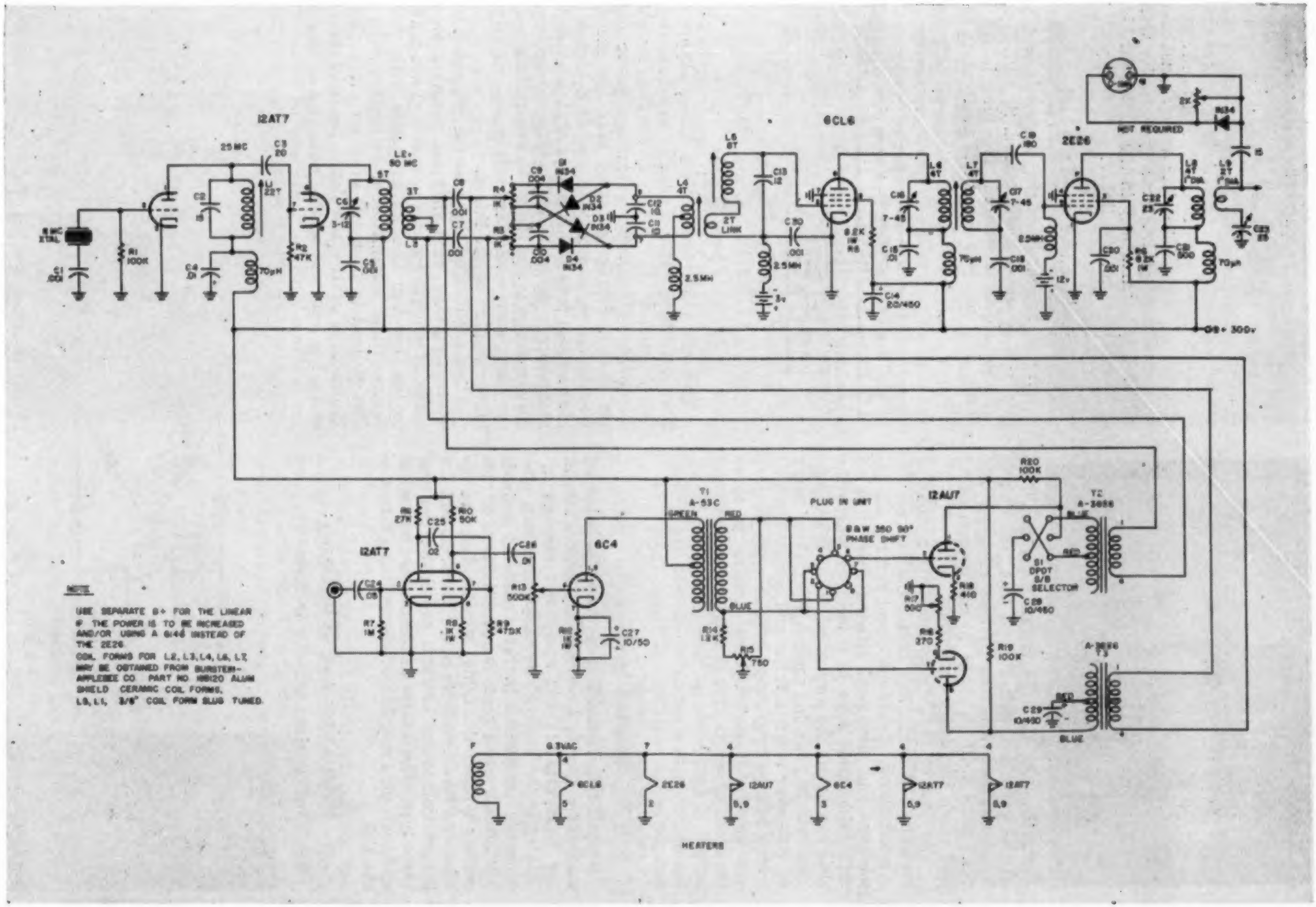
Three slug-tuned ceramic coil forms with aluminum shields were used for L_2L_3, L_5 and loop, and L_6L_7. L_4 is a standard ⅜ coil form tuned to the desired frequency. The ceramic coil forms can be obtained from Burstein-Applebee, part number 18B120 for less than a half dollar each. They can be dismantled for rewinding your own coils. The coil forms are ½ inch in diameter.

Let's get with the building of the exciter. Each section of the exciter will be described separately except for the chassis. Refer to the lay-out drawing and photographs for location of components. Cut all holes in the chassis and install all sockets.

For L_1 a ⅜ inch ceramic slug tuned coil form coil was used. Wrap 22 turns of #24 beldenamel wire closely wound over the form.



Chassis Layout


12AT7
8 MC XTAL
C1 .001
R1 100K
25 MC
C2 15
L1 22T
C3 20
C4 .01
70µH
R2 47K
C6 3-12
L2 50 MC
5T
C5 .001
3T
L3
C8 .001
C7 .001
R4 1K
R3 1K
C9 .004
C10 .004
D1 IN34
D2 IN34
D3 IN34
D4 IN34
C12 10
C11 10
L4 4T
2.5MH
L5 6T
2T LINK
C13 12
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8.2K 1W R5
C16 7-45
L6 6T
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C17 7-45
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C20 .001
R6 8.2K 1W
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C21 500
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70µH
L9 2T 1" DIA
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C23 25
2K
IN34
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B+ 300v
12AT7
C24 .05
R7 1M
R8 1K 1W
R9 470K
R11 27K
R10 50K
C25 .02
C26 .01
R13 500K
6C4
R12 1K 1W
C27 10/50
T1 A-53C
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R18 410
R17 500
R16 270
R20 100K
R19 100K
T2 A-3856
BLUE
RED
S1 DPDT S/B SELECTOR
C28 10/450
A-3856 T3
RED
C29 10/450
BLUE
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6.3VAC
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2E26
12AU7
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12AT7
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HEATERS

NOTE

USE SEPARATE B+ FOR THE LINEAR
IF THE POWER IS TO BE INCREASED
AND/OR USING A 6146 INSTEAD OF
THE 2E26.
COIL FORMS FOR L2, L3, L4, L6, L7,
MAY BE OBTAINED FROM BURSTEIN-
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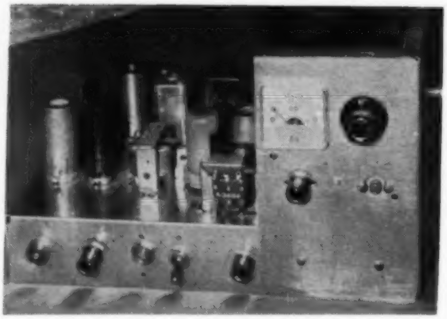


Shunt L_1 with C_2 a 15 mmfd capacitor. This should cover between 25 and 25.5 mc. Follow schematic and wire the oscillator. Apply 300 volts thru a 70 uh choke to the bottom of L_1 and check the oscillator output.

The doubler should come next. If a shielded ceramic coil form has been obtained as described above, disassemble and remove all capacitors and windings. Rewind five turns of #20 beldenamel wire in a location where the slug can be all the way in or out of the winds. This will be your fine tuning. Wind three turns of #24 over the five turns and center tap this which will go to ground. Assemble the doubler and apply voltage 300 volts. Locate the three turns up or down over the five turns until the output is near equal at both ends of L_2. Check the output with a vacuum tube volt meter. This completes the oscillator sections.

Balanced Modulators

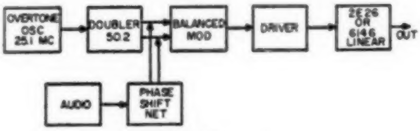
Install 1K, R_3 and R_4 pots near the balanced modulator socket. Fabricate the modulators in the Lafayette RY-262 equipment case as indicated in the figure. The modulators may also be made permanent in the exciter if desired. The author feels that the plug-in type of assembly is more desirable, because different diodes may be checked for best results. L_4 and the 2 turn link is on the same coil form. Use the same type of coil form as the doubler and wind one turn on each side of center tap of L_4 for the link.

6CL6 Driver and 2E26 Linear

L_5 is a ⅜ slug tuned coil form wrapped with #24 beldenamel wire. L_6 and L_7 made up on the 18B120 slug tuned coil forms. L_7 is wrapped over L_6, using #20 wire for L_6 and #24 wire for L_7. Approximately 300 milliwatts is obtained from the driver, which is enough to drive a 2E26 or 6146. No neutralization was needed with the 2E26. The linear indicated may be used or your own design. L_8 and L_9 are constructed of #14 solid wire; enamel insulated wire was used for L_9. Mercury batteries were soldered in permanently in the circuit for bias on the driver and the linear.

Audio and Phase Shift Net

Wire as indicated on the schematic and no problems should be encountered. S_1 DPDT selects the sideband desired. The plug in B&W phase shift net is a jewel and really does the job.

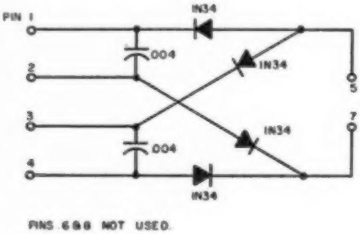


Block Diagram

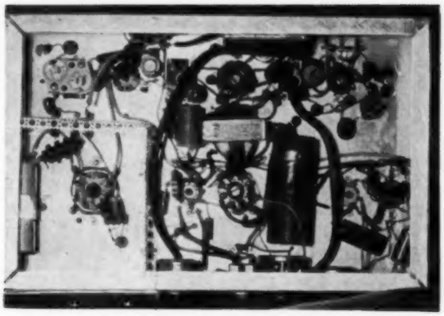
Power Supply

The only requirement for a power supply is that it delivers 300 v B plus at approximately 180 ma. and of course 6.3 v ac for the filament. The author did not use a regulated power supply, but it can be expected that the exciter would perform better with one. If a higher B plus is used it is recommended that a separate plate supply be used and a 300 v regulated supply. Refer to the Radio Amateur's handbook for plate, screen and bias voltages when using higher B plus on the linear.

After completing the construction check all wiring, making sure that no mistakes were made. If everything checks good you are ready to fire her up. Use an rf probe with your vacuum tube volt meter in connection with a dummy load to tune and peak up the exciter. To inject a carrier unbalance the modulators and a low level will be obtained. This is enough for peaking. With the power applied adjust R_{17}



Balanced Modulator

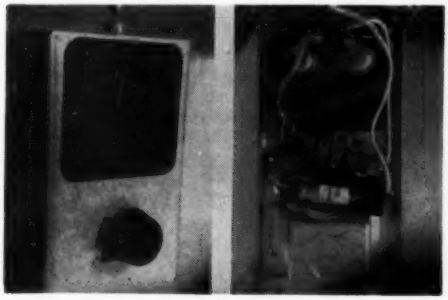


until both plates of the 12AU7 are approximately 175 volts. When the modulators are balanced, the carrier should drop almost to zero. Using an audio oscillator or a mic, adjust R_{13} and R_{15} for quality; you may check this on your receiver. Watch the meter swing up when modulating. To get a real check of the exciter put an SWR meter in your antenna line and check with your buddies for best settings of R_{13} and $_{15}$. Good luck during next summer's Sporadic E season. Give me a call. . . . K8NIC

Field Strength Meter for 6 and 10

Allan Schechner W3YZC

A field strength meter doesn't have to have transistors or tunnel diodes to be sensitive. Just observing a few basic principles such as tuning and matching helps. Most hams are familiar with the timeworn field strength meter circuit using an rf choke, diode and a milliameter; in fact it is probably the most commonly used type. With this arangement, however, there is a large mismatch between the low impedance meter and the whip antenna. Not only that, the meter will respond to spurious frequencies. This meter incorporates an antenna "loading coil," which in one fell swoop tunes and matches the circuit, and effectively lengthens the antenna. The secret is that the coil is constructed by "cut and try" so that it matches the builder's particular circuit.



Using a surplus 500 microamp meter commonly available for $1.75, the circuit is wired as in Fig. 1. This wiring is not critical as to layout; winding the coil is.

Cement a seven inch length of #12 tinned wire into the body of a banana jack by first forming a loop in the wire to obtain a pressure fit. Drill a 1/64 inch hole as in Fig. 2 and fish the end of a five foot length of #24 enamel wire into it. Solder the end of the wire to the metal part of the jack and screw this part into the plastic, while twisting the wire in the hole to take out the kinks.

Start the winding with 45 turns, which should take you to the end of the plug and tap solder the wire to the antenna. Loosely couple a grid-dipper to the coil and check frequency. Remove two turns at a time until you hit 29 mc. First check the grid-dipper with a communications receiver to be sure you know where 29 mc is with some degree of accuracy.

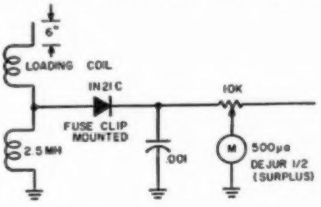


FIG. 1

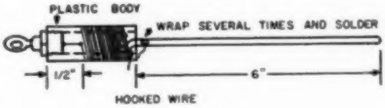


FIG 2

During the coil pruning operation, the grid-dipper should be far enough from the F.S.M. so that only a slight indication is noted on the microammeter. This prevents detuning of the loading coil. When the coil is completed, permanently solder the end of the winding to the antenna, covering the whole assembly lavishly with coil dope.

After completing the electrical portion the author found that an Ajax magnetic door latch could be fastened into the bottom of the case. This allows the tiny meter to be firmly attached to metal surfaces such as the roof, trunk or dashboard of a car. Cut a 5/16 inch by 1⅛ inch slot as indicated for the magnet to protrude through the bottom and cover this with a thin piece of tape to protect it from scratching.

By removing more turns the unit will operate on six meters. Using the banana jack makes it convenient to construct a set of antennas. Start with thirty five turns for the six meter winding. When in use, you will almost certainly find a need to use gain control R_1 to reduce sentitivity. . . . W3YZC

Forty Meter ZL Special

Doug Gaines W4AXE
2323 S. E. 11th Street
Gainesville, Florida

AFTER struggling through the morass of commercial broadcast stations around 7135 kc to copy the Florida RTTY Emergency Net one Sunday afternoon, I staggered out of the shack swearing never again. Unless you've had the experience of being kicked in the head by several foreign soap operas crying to the tune of 50 kilowatts or so each, it's hard to imagine the exasperation involved in trying to work RTTY on forty from this location. As I had the coverage of Florida primarily in mind, and the working of stations on the Eastern Seaboard as a second consideration, I decided that a fixed antenna with good forward gain and high front to side ratio would fill the bill.

The ZL special has been around for a good number of years but has been used mostly on ten, fifteen, and twenty meters. After reading the specifications, this seemed to be a good prospect for my beam.

The antenna described here is a variation of the ZL special and is a good compromise of good gain and directivity, small space requirements, and best of all, low construction cost. The total list of supplies consist of two 2x2's, 300 feet of wire, a hank of TV twinlead, and twelve insulators which can be cut out of plexiglass. Before we begin the description, let me say again that this was not built for a DX antenna, but rather for good coverage of Florida, of which 80 percent lies south of this location. However, when it was temporarily raised to sixty feet, the first contact was in South America.

Basically, the antenna is a pair of folded dipoles fed 135° out of phase. The ends of the elements are drooped downward to form a pair of inverted V's hung from a common boom. All wires on each side of the boom are in the same plane, resulting in the whole array looking something like a four element beam.

Construction begins with the boom which can be of either wood or tubing cut to 17 feet 6 inches. I used two 2x2's butt-jointed and reinforced at the center to reduce sagging. Insulators were fastened at each end and at 18 inches in from each end as shown in Fig. 1. The director consists of a folded dipole resonated at the desired frequency. The reflector is cut about 8 percent longer until the antenna is raised and tuned. Between the feedpoints of the two elements, a length of 300 ohm TV lead-in is connected with a half twist for the phase shift. This lead-in handles my kilowatt okay in this application. The feedline is connected at the feedpoint of the director. With the dimensions given for 7140 kc or using the formulas in Fig. 2 for other frequencies, the impedance is close to 75 ohms. I played around with 75 ohm twinlead and baluns for my transmitter. Needless to say, bandswitching became a dismal affair. In desperation, I tied on RG-11, and, wonder of wonders, it worked! The pi-network of my linear was quite happy with the new load.

The end wires of the director were adjusted in and out until a low point was found in the SWR at the desired frequency. When the best point was found, the wires were soldered in place. The reflector was tuned in the same way for maximum gain, using a field strength meter. This was done with the boom raised to its permanent height and the elements stretched out to their approximate tie points. At this location, the apex of each V is at 40 feet and the apex angle is 60 degrees. Sharper angles tend to decrease the usable bandwidth and directivity. As this angle is decreased, a point is reached where the array becomes too critical to tune. This point seems to be at an angle of 30°.

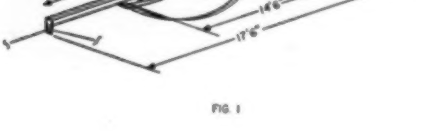
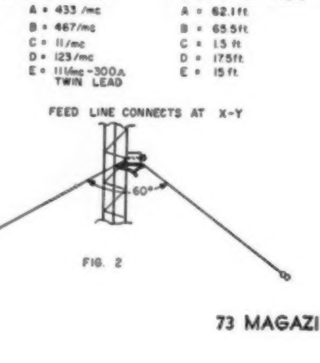


FIG. 1



GENERAL FORMULA	DIMENSIONS FOR 7140kc
A = 433/mc	A = 62.1 ft
B = 467/mc	B = 65.5 ft
C = 11/mc	C = 1.5 ft
D = 123/mc	D = 17.5 ft
E = 111/mc – 300Ω TWIN LEAD	E = 15 ft

FEED LINE CONNECTS AT X–Y

FIG. 2

175 WATTS SSB ON SIX METERS with P & H 6-150 TRANSMITTING CONVERTER

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WRITE FOR LITERATURE

P & H ELECTRONICS INC.
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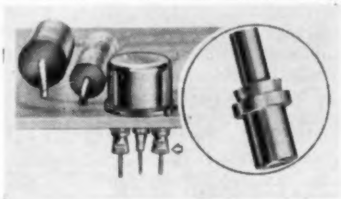
This is a simple antenna to build if you have a structure such as a pole, tree, or tower that can support the boom at 30 feet or more. 40 feet seems to be a good height for working stations out as far as 400 miles. The labor is well worthwhile when the performance is considered.

I checked gain against my dipole, which is 20 feet higher than the beam. When transmitting, forward gain to stations 100 miles or closer is about 6 db better than the dipole. On longer hauls, it is closer to 10 db as reported on good receivers, such as 75A4's, HQ-180's, 75S-1's, etc. On receive, a real mystery pops up. When I switch from the dipole to the beam, signals from the South jump at least three S-units. This dipole is a good one, too. The high readings may be due to a greatly different radiation angle or to the presence of obstacles in the field of the antennas. I think that a more likely reason is the same thing that makes the cubical quad and dual-diversity beam such good receiving antennas. All have a large cross-section and each has nearly an equal proportion of vertical to horizontal components. Front to side ratio is about 25 db measured with a field strength meter. Front to back was purposely kept low, as I did not want to lose northern stations. Stations to the East and West are down far enough to make forty meters much more comfortable to work.

So, fellows, let's don't let forty fall by the wayside as a reliable band because of small space. This antenna can take up almost as little space as a full sized twenty meter beam and is still full sized on forty. Don't be persecuted by Russian propaganda stations or get involved in *John Loves Mary* in Spanish. Put up the Inverted-V ZL-Special and live! . . . W4AXE

A Grabber



Soldering leads shortens transistors life. Heat sinks, often not infallible, necessitate undesirably long transistor leads. What do we do? We build transistors, beautiful little gems, expensive little gems. Then we blithely ruin them by the thousands trying to solder them into the circuit. The solution? Classically simple. Don't solder transistor leads. Insert and solder special crimpable eyelets in the circuit. Then slip the transistor leads thru these and crimp, giving a positive electrical connection and the shortest one possible. I know. *I* should have thought of it, too. *Vector* has them all ready to go. They're called TRANSCRIMPS, available from Vector Electronics, 1100 Flower St., Glendale 1, Calif.

73 Tests the Poly-Comm 62B 6 & 2 Meter Transceiver

Roy E. Pafenberg W4WKM

A strong newcomer in the VHF equipment field is the Poly-Comm Model 62B, 6 and 2 meter transceiver. This compact little unit is designed for mobile and home station use, containing a universal power supply for both modes of operation. Study of the specifications will show that the manufacturer, Polytronics Lab Inc., really took on a task in designing the unit.

This transceiver proved to be very difficult to evaluate. The time proven approach is to compare any new equipment with the competition in the areas of features provided, performance and cost. In this instance, the usual yardsticks do not exist. No competitive product provides 6 and 2 meter coverage, self contained universal power supply and self contained VFO for both bands.

The photo shows the external details of this attractive little package. A universal mobile mounting bracket, provided but not shown, allows the unit to be mounted in almost any mobile location. Before going into the results of the test, a brief circuit description is in order. Reference to the block diagram and the specifications will assist in understanding the following discussion.

The receiver section, designed for AM reception only, consists of a 12 tube superheterodyne circuit using triple conversion on 2 meters and double conversion on 6 meters. A high gain, cathode coupled, dual triode rf stage works into a Nuvistor first mixer. A 94 mc, crystal controlled Butler oscillator supplies the injection signal. On 6 meters, the oscillator is disabled and the signal idles through the first mixer. A voltage regulated, Colpitts oscillator, operating at 46.595 ±2 mc is used to supply injection to the second mixer. The oscillator and second grid mixer circuits are gang-tuned, resulting in a second *if* frequency of 5.405 mc. A stage of amplification follows, feeding the third mixer. Here, a 4.95 mc crystal oscillator is used to produce the final 455 kc *if* frequency. Two stages of 455 kc amplification are used to obtain the desired selectivity.

It will be seen that the rf-*if* portion of the receiver section is essentially a good design, double conversion 6 meter receiver with a high performance, crystal controlled converter used to provide 2 meter coverage. The results are very good and actual tests show that the claims of image rejection and selectivity are actually exceeded in production. The price paid for this superior performance is the presence of the two spurious responses pointed out in the specifications.

Silicon diodes are used in the detector, AGC delay and ANL circuits to provide excellent, hum-free performance. A dual triode is used in the squelch and first audio stages which drive the parallel connected 6BQ5 audio output tubes. These tubes, which are also used as modulators in the transmit condition, drive an internal 2½" PM speaker. Rear-chassis terminals are provided for use of an external speaker if desired.

The 62B transmitter section is more or less conventional except for the inclusion of the internal two band VFO. A switch permits selection of the VFO or a front panel mounted crystal. The oscillator frequency is tripled in the plate circuit and feeds a frequency doubler, driving the 7551 output stage on 6 meters. An additional tripler stage is switched in to give 2 meter coverage. The modulator consists of a high gain pentode followed by a triode which drives the 6BQ5 modulator tubes. The ceramic microphone supplied with the transceiver is matched to the speech system for optimum re-

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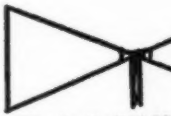

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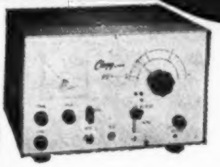

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sponse. A side advantage is that the audio gain may be fixed and still provide good performance.

Antenna feed requirements for both the transmitter and receiver are a reasonably flat 51 ohm termination. SO-239 connectors are used for separate 6 and 2 meter antennas. In the event one of the increasingly popular two band antennas is used, an internal strap connection will permit using a single connector for both bands.

The internal power supply employs a special power transformer which allows operation from the ac line or, using a conventional vibrator circuit, operation from 12.6 volts dc. Circuit switching is accomplished by inserting the appropriate power cord in the chassis connector. Four silicon diodes in a voltage doubler configuration supply the high voltage requirements. Another silicon diode powers the dc relays when the transceiver is operated from the ac line.

The unit loaned for the test, Serial Number 12B719, was accompanied by a letter from Bud Hargreaves, W2SXB, Chief Engineer of Polytronics. The letter said, in part, ". . . We have found that evaluations of equipment have been stilted and have been directed toward the good points, etc. We hereby authorize you to mention any undesirable features which you may find in the unit. . . ." Bud went on to specifically mention a couple of problems in the equipment. Some problems exist in any product but they are normally kept a dark secret by the manufacturer. If an unwitting user points out one of these problem areas, the manufacturer all too often expresses shocked surprise that such a condition could exist. The frank and open attitude of Polytronics is indeed a refreshing change.

Bud's statement was taken at face value and the transceiver really put through its paces, both on the air and on the bench. A local amateur, who prefers not to be identified, had expressed an interest in looking over the 62B and I was quick to take advantage of his experience. His competence is based on many years of professional and amateur VHF equipment design experience and backed up by some rather extensive test facilities. After inspection and limited testing, the unit was hauled to the basement lab and given the works. The tests resulted in 8 pages of notes, too lengthy to reproduce here. Environmental testing equipment was not available so specifications relating to temperature, shock, humidity and vibration were not checked. I don't claim that full-fledged compliance testing was conducted but a wealth of equipment was available and the balance of the specifications were checked out to the extent required to detect any serious departure from the manufacturer's published claims.

The 62B appeared capable of meeting or exceeding all specifications except those on transmitter VFO stability. As noted in the specifications, frequency stability of the VFO is cited as being within ±.02% from −20° C to +60° C. This figures to be ±29.2 KC at 146 MC. Bench tests showed drift in excess of this. Tests were conducted at room temperature of 21.5° C, using thoroughly warmed up and calibrated equipment. The 62B was turned on after being off for 24 hours and the VFO "spot" switched on only long enough to accomplish the measurements conducted at 5 to 10 minute intervals. Results, from a starting frequency of 144.312 MC, were as follows:

VFO drifted down 106.0 kc in 1st 30 minutes
VFO drifted down 24.0 kc in 2nd 30 minutes
VFO drifted down 12.0 kc in 3rd 30 minutes
VFO drifted down 2.5 kc in 4th 30 minutes

At 5 hours and 36 minutes, the transmitter was operated key down for 10 minutes, resulting in an adidtional downward drift of 600 cycles. At the conclusion of this test, a thermometer placed loosely on the top of the cabinet read 53° C, a rise of 31.5° C over ambient.

Receiver stability measurements were conducted on 2 meters and performance was within specifications of ±.06%. This test was conducted by accurately measuring the second oscillator frequency. From a cold start, the unit drifted up 27 kc in 35 minutes and then drifted down 12 kc in 1 hour and 37 minutes. Drift on 6 and 2 meters is essentially the same.

Inclusion of the VFO feature in a 6 and 2 meter transceiver of compact construction poses many problems. Extreme supply voltage and temperature variations, vibration and shock are present in mobile operation. The oscillator tank switching problem is another obstacle that must be overcome. Polytronics has chosen the oscillator-frequency multiplier approach and the results serve to highlight the problem. The stability, while certainly not the best, is probably as good as can be expected in a competitively priced equipment of this type.

While the "state of the art" approach of a limited range, high frequency VFO and crystal controlled frequency converters could be used, a number of tuning ranges would be required for full coverage of both bands. Further, the increased circuit complexity required to reduce spurious output frequencies would probably price the equipment out of the market.

The balance of the test proceeded nicely. Receiver performance is all that is claimed. Selectivity was found to be even better than that cited in the specifications. 6 db bandwidth was measured at 3.9 kc and 40 db bandwidth at 19.5 kc. This degree of selectivity is very comforting to have, however it imposes more stringent stability requirements on the receiver circuitry and makes any drift in the received signal more pronounced. Retuning of the 62B is required during warm up. Sensitivity is excellent and overall performance such that weak signals really come up over the noise. S-meter readings were correlated with input level and each S-unit between S1 and S8 reflected an average of 5.4 db increase in signal level. Image rejection is exceptionally good. The second and third *if* frequencies could not be detected on the 2 meter band, with the full 2 volt output of a General Radio 805-C signal generator pumped into the antenna connector. The two 2 meter spurious responses were present at the predicted intensity.

The receiver audio system is more than adequate and no trouble was encountered with microphonics when using the internal speaker. The shock mounting used for the receiver tuned circuit assembly and the transmitter VFO really shows its merit under conditions of vibration and shock. The squelch circuit works well and can be set to trip on signals way down in the noise. The squelch threshold is fully adjustable and the adjustment holds for extended periods.

Power output of the transmitter was measured, using a Bird Termaline Model 61 RF Wattmeter. Measured power output into this 50 ohm load of 9 watts on 54 mc and 5.5 watts on 148 mc agreed with the final inspection check list packed with the transceiver.

I was very much impressed by the quality of components used in the 62B. Teflon insulated wire is used throughout the unit and all metal parts are heavily plated. The quality of workmanship in the assembly and wiring is uniformly good. Careful attention to mechanical details, including the shock mounting of the receiver tuning elements and VFO, contribute to the overall performance. Physical layout of the front panel is good although the compact size of the unit does make some compromise necessary. The front panel mike connector is comparatively large and, as a consequence, the PA tuning and loading controls are a bit difficult to reach. Fortunately, these controls do not require constant attention so no hardship is imposed. The recessed front panel provides ideal protection for the controls in the mobile environment and this feature should not be sacrificed. However, when the unit is placed on the operating table, the meter and dials are somewhat obscured by the cabinet overhang. Flip-out extension feet mounted on the bottom front of the cabinet would tilt the transceiver at a convenient viewing angle.

On the air performance was excellent and, except for some comments on VFO drift, reports were consistently good. Modulation quality was reported as excellent. Receiver drift was noticeable during warm up but, once stabilized, the receiver is a real pleasure to operate. I believe the logical approach is to accept the VFO as a bonus feature, to be used as a crystal substitute only as required. The dual band coverage and many other desirable features result in overall performance of the 62B that places it ahead of competitive factory assembled products on the basis of dollar value received. . . . W4WKM

(Turn page for Specs.)

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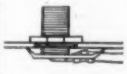

Mounts flat; only uses ⅜" inside roof.

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TRANSCEIVER:

Frequency Coverage: 49.75 to 54.25 mc; 143.75 to 148.25 mc.

Tube Complement: 16 tubes, 5 silicon rectifiers, 3 silicon diodes and 5 gas regulators.

Antenna: 50 ohm line. Separate SO-239 Connectors for 6 and 2 meters with optional strapping for 2 band antennas.

Power Source (—20 to +10% of rated input voltage): 117 volts 60 cycle ac at 90 watts receive, 140 watts transmit, or 12.6 volts dc at 10 amperes receive, 16 amperes transmit.

Front Panel Controls: VFO-Xtal Switch, Receiver Tune, VFO Tune, Volume, Squelch, Antenna Trimmer, Band Switch, Driver Tune, PA Plate Tune, Antenna Loading and Meter Function Selector.

Size: 11" wide x 10" deep x 5" high.

Weight: 15 pounds.

Finish: Marine gray with maroon knobs and white lettering; brushed aluminum grill.

Accessories Supplied: Ceramic microphone with retractable cord, universal mobile mounting bracket, ac power cord and battery power cord.

Accessories, Optional: Base station microphone and 2 & 6 meter dual band antennas.

TRANSMITTER SECTION:

Type Circuit: Separate oscillator, multiplier(s) and straight through amplifier.

Plate Power Input To Final: 18 watts on 6 meters, 17 watts on 2 meters.

Modulation Capability: 85 to 100% at average voice level using plate modulation.

Hum And Noise On Carrier: At least 40 db down from 30% modulation level.

Harmonic Suppression: All harmonics and spurious emissions better than 50 db down.

Frequency Control: VFO or crystal.

Crystal Stability: ±.005% —30°C to +70°C.

Crystal Circuit Stability: ±.006% —20°C to +60°C.

VFO Stability: ±.02% —20°C to +60°C.

RECEIVER SECTION:

Type Circuit: Triple conversion superheterodyne on 2 meters, double conversion on 6 meters.

Calibration: 100 kc graduations every 4° with 6:1 tuning ratio.

Sensitivity: Better than .2 microvolt on 6 meters and .3 microvolt on 2 meters for 6 db S+N at 30%, 1000 cycle modulation.

Selectivity: —6 db bandwidth 8 kc ±2 kc; —60 db bandwidth 25 kc ±5 kc.

Delayed AGC: Audio output varies less than 3 db for inputs between 1 microvolt and .1 volt.

Squelch, Adjustable: .08 microvolt threshold on 6 meters, .1 microvolt on 2 meters.

Noise Limiter: Floating series gate type.

Audio Output: At least 2 watts into $2\frac{1}{2}$" internal speaker or 3 watts into external 4 ohm speaker with less than 15% distortion at 1 watt.

Hum And Noise: Better than 40 db down from 1 watt output.

Frequency Response: Within +1 db to —5 db from 250 to 3000 cycles.

Image Rejection: 1st image better than 85 db down, 2nd image better than 60 db down and 3rd image better than 85 db down.

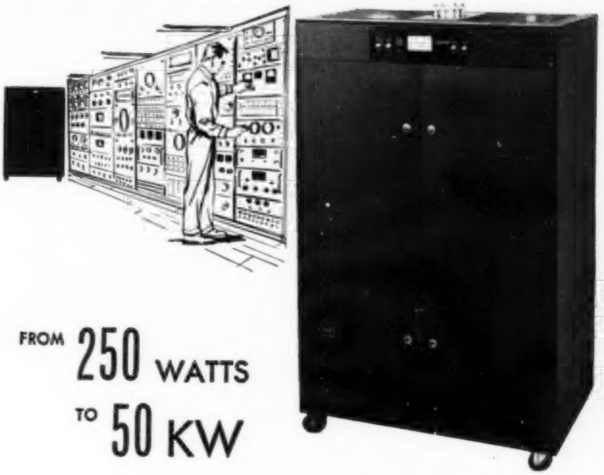
Spurious Responses: Better than 60 db down except within ±20 kc of desired signal.

Internal Generated Spurious Signals: 145.17, approximately 90 microvolts (S9); 147.80, approximately 80 microvolts (S8).

Cross Modulation and Desensitization: Better than 50 db down at ±20 kc.

IF Frequencies: 52.00 mc (±2 mc), 5.405 mc and 455 kc.

Stability: ±.06% from —20°C to +60°C.



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TMC MODEL NUMBER	MILITARY NOMENCLATURE	FREQUENCY RANGE	AVERAGE POWER (In watts)	PEAK ENVELOPE POWER (In watts)
TER-250-300 U		DC to 30 mc	250	300
TER-500-70 U		DC to 30 mc	500	1000
TER-500-600 B	DA-199/U	DC to 30 mc	500	1000
TER-1000-300 U		DC to 30 mc	1800	3600
TER-3500-70 U		DC to 30 mc	1750	3500
TER-3500-600 B	DA-200/U	DC to 30 mc	1750	3500
TER-5000-70 U	DA-210/U	DC to 30 mc	5000	10,000
TER-5000-300 U		2-30 mc	5000	10,000
TER-5000-600 B	DA-201/U	DC to 30 mc	5000	10,000
TER-18KA-50 U		DC to 30 mc	18,000	36,000
TER-18KC-50 U		DC to 30 mc	18,000	36,000
TER-18KA-70 U		"	18,000	36,000
TER-18KC-70 U		"	18,000	36,000
TER-18K-600 B		4-28 mc	18,000	36,000
TER-18K-600 BF		4-28 mc	18,000	36,000
TER-25KA-50 U		DC to 30 mc	25,000	50,000
TER-25KC-50 U		"	25,000	50,000
TER-25KA-70 U		"	25,000	50,000
TER-25KC-70 U		"	25,000	50,000
TER-25K-600 B		4-28 mc	25,000	50,000

For companion RF Broadband Transformers refer to Sales Service Bulletin #8015.

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Ham Radio in Finland

John Velamo OH2YV
Isokaari 4-B-30
Lattasaari, Helsinki
Finland

THE Finnish Amateur Radio League, SRAL, is among the oldest amateur radio organizations in Europe. It was founded officially in 1921, so this spring means the 41-year milestone to it. However, long before this there was considerably strong amateur radio activity in Finland; some of the still active Finnish amateurs were 'in the business' already around 1913-14, not to mention the actual pioneers who are not living among us any longer. Let us mention only A. Tigerstedt who developed the vacuum tube in a way that the Germans adopted as an important military secret that time. Leo Lindell OH1NA, silent key in 1936, is said to be the founder of SRAL, also the first Finnish radio amateur. In addition to these the amateur radio has many traditions in Finland.

The membership of SRAL (*S*uomen *R*adio-*a*matoori*l*iitto) is about 1800. Approximately 1600 of them are licensed amateurs. The country is divided into ten districts, OH1-OH0, OH0 Aaland Islands having selfgovernment and thus counting as a separate country from Finland in the Amateur World. The maximum input power allowed to OH stations in the General class is 200 watts on 80-40-20-15-10 meter bands as well as on the VHF bands. There are possibilities that special permission will be granted to OH amateurs for operating on 160 meter band with a maximum of 10 watts input power.

The amateurs in Finland are divided into three classes: Technical, Novice and General Class. Technical Class requires knowledge of electrical and radio technics and regulations for amateur radio. However, no code speed is required. Novice Class requirements consist of basic knowledge of electrical and radio technics, code speed of 8 wpm plus regulations for amateur radio. General Class requirements are 12 wpm code speed, good knowledge of radio and electrical technics, considerably good ability to communicate on the bands, not to mention good knowledge of amateur radio regulations etc. In general the requirements are much like those in the USA. Technical Class license allows 200 watts on 144 mc and higher bands, CW or phone. Novice Class allows a maximum of 15 watts input power on 3510-3545 kc, 7020-7050 kc and 21060-21150 kc CW only, and the transmitter must be crystal controlled. After making at least 300 QSOs the Novice will be allowed to try to pass the General Class examination. The Novice class license is valid for a maximum of three years, and it will not be renewed. The General Class rights are those already mentioned.

W6AM visiting Finland in 1961 summer. OH2XK, OH2RM, K2RKN/OH2QZ, OH2XZ of U.S. Embassy, W6AM, in shack of OH2XZ.

OH2YV John Velamo, General Secretary of the SRAL of Finland, honorary Secretary of the Award Hunters' Club, President of the local radio club, member of A1-OC, Tops-CW-Club, HSC, Rcc, etc.

In Finland there are possibilities to any foreigner to get an amateur license and an OH call. However, this is based mainly on the reciprocal agreements, but many exceptions have been done, too. At the present time there is one American (OH2XZ), one Australian, and one Norwegian amateur licensed in Finland. Earlier there have been a few Englishmen, a few Swedes, etc. At the present time it seems that the Finnish authorities are in favor of the reciprocal agreements because applications of some amateurs of "non-reciprocal" countries have not been accepted. In Finland the authorities have given SRAL the rights to control the radio amateur activities; probably Finland is the only country in the world where the official league has such duties and privilege! This system is working well, and violations against radio laws happen very seldom among the Finnish radio amateurs. The control work of SRAL is mainly advising but in serious cases SRAL has right to propose cancelling of certain amateur radio licenses. Thus the amateur radio activity in Finland is extremely free, however the system gives SRAL very serious duties and sometimes causes certain difficulties especially when violations are notified.

The DX activity in Finland is on a high level, as an average. The high top man probably is OH2NB with approximately 300 countries worked. OH5NW comes with some 260 countries on *phone* alone. Over 30 OH amateurs have more than 180 countries worked; they represent about 7-8% of the continuously active OH amateurs. The contest activity in Finland is high, especially in the international contests like WAE-contest, ARRL Competition etc., and before all the Scandinavian Activity Contest which usually show very strong OH activity on the bands. The number of OH's in these contests usually is among the highest in the whole world. SRAL issues three awards, OHA, OHA-100 and OHA-300, for contacting OH amateurs. Rules of these are available from Box 306, Helsinki.

Among other international activities in Finland there can be mentioned also the WDT and CRC awards, WDT being issues by the Tampere gang (OH3), and CRC award by the Radio Club of Cafe de Colombia (hi!). CRC has meetings *daily*, at the luncheon time, and thus it can be said to be the most active amateur radio club in the world! Furthermore, the oldest and original award and certificate hunters' organization, the Award Hunters' Club (AHC) has its headquarters in Finland. Newest addition to the Finnish certificates is the VRCC for the Finnish Railroads 100-year jubileum, issued by the railroad amateurs.

The local club activity in Finland is lively, too. There are nearly 30 clubs altogether, representing practically all Finnish cities. These clubs include most of the active OH amateurs in their membership. The biggest of them is the OH2-Club, "Kakkosten Kerho," with a membership of approximately 300. The smallest clubs contain around 5-6 members. The Club stations usually have call signs beginning with the letter 'A,' OH1AA, OH2AA, OH5AC, OH6AB etc. The Headquarters call is OH2A, having also been used as OH4A, OH9A and OHφA.

OH7NF Eino Toivanen, the 7 mc specialist with 156 countries on forty cw. Old Timer, one of the European pioneers on 28-mc—operating world-wide in the early '30s.

President of the OH YL amateurs, Marie OH2FB (XYL of OH2YV).

There are approximately 35 YL and XYL amateurs in Finland. A few of them are in the Novice Class. Their activities are not extremely strong on the bands; merely they seem to like to arrange meetings. Mostly the OM's of the XYL amateurs are licensed hams, too.

OH2NB Armas Valste, the top DXer of Finland. Old Timer, one of the first Finnish Radio Amateurs.

The youngest OH amateur is OH2BAD, 13 years of age, good "runner-up" being OH2BL with 14 years of age. They both are still in the Novice Class but very soon they will be changing the final tube to bigger . . . The Novice Class system has given very good experience in Finland as to the operating ability and skill of amateurs. The General Class amateurs coming from the Novice Class regularly show a very good skill on the bands; this is

(Turn to page 77)

James G. Lee W6VAT
Box 45621
Los Angeles 45, California

An Extra Hand in the Shack

Dot Maker

MANY times while trying to track down TVI, BCI, Parasitics, etc., in a transmitter, two hands are just not enough to key the transmitter, tune an absorption wavemeter and TV set all at the same time. If there is someone else around to assist this is no problem, but when one is alone it is impossible to be in two places at once. "DOT MAKER" can help solve this and other problems.

The basic circuit, shown in Fig. 1, is a free-running multivibrator. This circuit is due to Courtney Hall[1], and is probably one of the simplest multivibrator circuits to be found. Yet, it is reliable, stable, consumes very little power, can be synchronized, and can be wired in only a matter of minutes. In Fig. 1, when voltage is applied, C begins to charge through V_1 and R_2; the current through R_2 cuts off V_2. When C has charged, V_1 cuts off. Since no more current is flowing through R_2, V_2 conducts and discharges C through R_1. The original condition is now restored and the cycle starts over again. V_1 and V_2 can be combined into a single tube envelope such as a 12AU7, 12AX7, 12AT7, and other similar types. Capacitor C may be switched to provide different rates, and if synchronization is desired, the grid of V_2 can be returned to ground through about 200K ohms and sync voltage coupled to the grid of V_2 through a capacitor. The output should only be taken from the cathode of V_2 since it is not very sensitive to loading impedances as is the cathode of V_1. V_2 acts as a cathode follower in this case.

The frequency is changed by changing the capacitor and/or the resistors. Making R_2 variable and switching in different values of C gives a very wide frequency range.

Referring to Fig. 2, the actual circuit of "DOT MAKER," one 12AU7 is used as a low frequency multivibrator to operate relay K_1, an 8000 ohm Sigma 4F relay. Its contacts key an external circuit by way of the terminal posts mounted on the edge of the Minibox. The second 12AU7 is an audio oscillator which can be used with phones, a speaker and output transformer, a pre-amp, or other reasonably high input impedance audio device for monitoring purposes. The 500K pot in the keyer gives a pulse rate of approximately 2 cps to 70 cps, and although this particular Sigma relay will not follow over this entire range, it does follow over a major portion. There are two reasons why just any relay wouldn't follow over the whole resistance range. One is that the current is drawn in short pulses and at the high resistance end of the pot, i.e., low pulse fre-

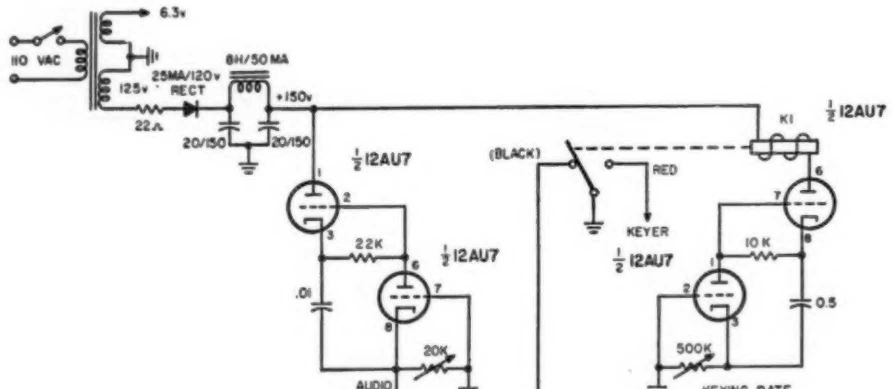

Fig. 2

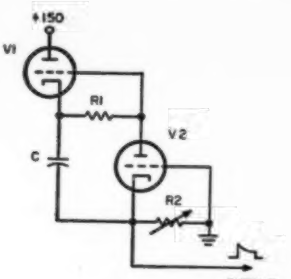

Fig. 1

quencies, it is not always enough to cause the relay to operate. The second is that at the low resistance end of the pot, the relay cannot follow because of the armature inertia.

The Sigma relay used in this version has both adjustable contacts and spring tension, consequently it can be adjusted for maximum range. This is a desirable feature, although not absolutely necessary. As long as the relay will operate on 1 to 2 milliamperes no problems should be encountered. The armature contact need not be grounded if desired; however, if it is not, the insulation voltage of the relay may be exceeded when keying in certain circuits.

The audio oscillator may not appear very useful here, but it serves several purposes. Plugging a speaker and output transformer into the phone jack allows an audio monitor of the keying rate when checking for TVI, BCI, etc. For checking AM operation the pulsed audio can be fed into the modulator and the rf envelope synchronized on a scope for detailed examination. If desired, it can be wired separately from the keyer and used as a code practice oscillator or as a keying monitor.

The "DOT MAKER" is wired in a 3 x 5 x 7 inch Minibox and there is plenty of room to spare. The power supply is straightforward and the actual votage is not critical. Current drain is very small in this particular circuit. Wiring is not critical nor is placement of parts, so no special care is needed for the construction of the "DOT MAKER." Any way you use it, "DOT MAKER" will be that extra hand in the shack you've always needed.

. . . W6VAT

[1] "STABLE FREE-RUNNING MULTIVIBRATOR," Courtney Hall, p. 38, July 1960, Electronic Equipment Engineering.

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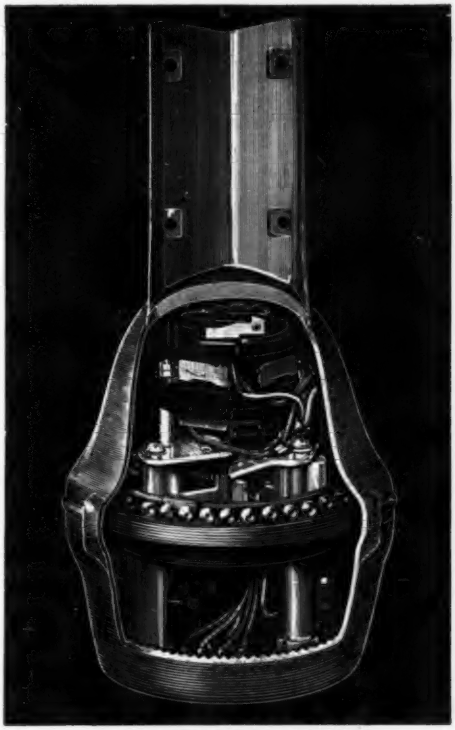

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An Accurate S-Meter

Jim Kyle
1851 Stanford Avenue
Santa Susana, California

WOULD you like to be honest, for a change, in the matter of giving signal-strength reports?

Those are strong words, yes, but if you rely on the scale of your receiver's S-meter and blithely quote a "60 db over S-9" reading, you're being far from honest. Let's take a closer look and see why.

To start, let's assume that our ancient tradition that one S-unit equals a 6 db change in signal strength is true. That means that every S-unit change in level doubles the voltage present at the receiver input.

Let's also assume that the non-existent "S-O" level represents a signal just exactly equal to the noise level of the receiver and the band in use. On 10 meters, this is usually equivalent to about 10 microvolts fed into the antenna terminals.

Now since every S-unit represents a doubling of the voltage at the antenna terminals, S-1 would equal a 20-microvolt signal. S-2 would be 40 microvolts, S-3 80, and so on until we find that S-9 equals 5,120 microvolts or 0.00512 volt. At S-9, we begin running into "db over"; these usually increase 20 at a whack—but 20 db represents a tenfold increase in input voltage. Thus, "20 db over S-9" would be 0.0512 volt, "40 over 9" would be just over half a volt, and "60 over 9" would be a whopping 5⅛ volts! The largest voltage yet recorded at the input terminals of a receiver which wasn't connected directly to a transmitter is only a bit over 1 volt; therefore, unless the scientists who measure received signals are all wet, a "60 over 9" signal is just an optimistic figment of our imaginations.

The blame, though, doesn't rest entirely on our shoulders. Virtually every receiver built today which includes an "S-meter" is graduated to 20, 40, and 60 db over S-9—and the needle stays there much of the time, on most bands.

These S-meters have other faults, too—earlier we said let's assume that one S-unit equals a 6 db change in signal strength. With most S-meters, this is not so. The spread between S-1 and S-9 is actually 256 times, in voltage input, but most meters swing their needles across this range with less than a 10-time voltage change.

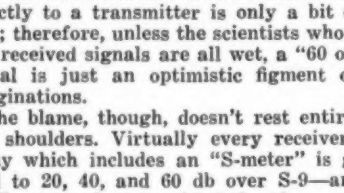


FIG 1.

If you want more of a sales talk, read almost any of Ed Tilton's writings—he has long conducted a campaign against meaninglessly inflated "S-Meter" reports; the purpose of this article isn't so much to convince you, as it is to show you what you can do about the situation for yourself.

You can build an *accurate* S-meter, capable of measuring incoming signals to the decibel in the range S-0 to S-9, for under $10 (less, if your junkbox is well-stocked). The accompanying schematic shows the circuit; here's how it works:

Basically, this "S-Meter" is a balancing type voltmeter measuring the voltage across the detector load resistor in 6 db increments, with a *fine* adjustment to allow continuous interpolation between the steps.

The voltmeter consists of three basic circuits: a reference voltage source, providing 10 reference voltages in 6 db switched steps; a "Kirschoff adder" which adds together the reference voltage and the input voltage; and an output indicator to show us when the output voltage is zero.

If the meter is adjusted to give zero output when both the *coarse* and *fine* knobs are set at "0" and the receiver is bringing in only noise, then the strength of an incoming signal in S-units and db above the noise level can be quickly determined by re-balancing the meter with the two knobs until the indicator once more reads "0", then reading the S-units from the *coarse* scale and the "db over" from the *fine* scale.

The heart of the circuit is the "Kirschoff adder," consisting of three fixed resistors and a potentiometer. This circuit is shown separately in Fig. 1; you can see that resistor R1 and pot R2 form one leg of a Tee, while resistors R3 and R4 form the other two legs.

With the resistance values shown, and R2 in its zero-resistance position, the two input voltages are added together algebraically and their sum appears at the output. However, since the reference is positive while the detector voltage is negative, this "addition" will result in an output voltage of zero if both inputs are equal.

Now let's take another look, but assume that R2 is in its maximum-resistance position this time. Now, the output voltage will be proportional to the algebraic sum of the detector voltage and *half* the reference voltage; the reference voltage has been multiplied by the ratio of R3 to R1+R2.

Actually, the output voltage is only proportional to the sums of the input voltages in both cases, because R4 acts as the lower leg of a voltage divider. Since we are interested only in one output voltage—zero—this fact is not important.

The maximum-resistance position of R2 corresponds to the +0db scale reading, and the zero-resistance position is the +6db scale reading. By switching the reference voltage in 6 db steps with R2 set to +0db, the *coarse* adjustment covers a range of detector voltages from approximately 1/16 volt to approximately 32 volts. Adjustment of the *fine* pot (R2) expands this range upward to 64 volts. Few receivers will handle a 64-volt signal level at the second detector, but most will produce 1/16-volt output with only noise input.

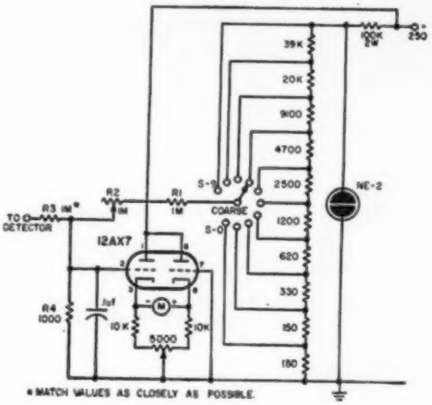
At this point, you may be wondering what will happen to detector performance, with a path from B+ to the detector. Here's where the voltage divider formed by R4 comes in. At its worst, the positive voltage at the top of R4 can be only 1/1000 of that at the top of the reference string—or 0.064 volts. This is further cut down by isolation through R1 and R2, to only microvolts at the detector.

The low voltages across R4 also make necessary the rather elaborate zero-indicator system composed of V1 and its associated resistors, in addition to the 50-0-50 microammeter. This circuit is a conventional bridge-type VTVM except that the cathode resistances are higher than normal; the meter indicates the difference in current flow in the two halves of the tube.

When the S-Meter is balanced, the current flow will be equal and the meter needle will rest in the center of its scale. When the S-Meter reading is weaker than the incoming signal, the needle will be above center; when the S-Meter reads less than the incoming signal strength, the needle will be below center.

Resistance of R2 in Circuit	Scale Calibration
1 meg	+0
782 k ohms	+1
589 k ohms	+2
415 k ohms	+3
262 k ohms	+4
125 k ohms	+5
0 ohms	+6

Table I. Calibration of R2 Scale.



* MATCH VALUES AS CLOSELY AS POSSIBLE.

FIG. 2

The meter used was chosen for price; Lafayette Radio sells this model for $2.95. However, you can use any meter of similar current capacity you may have; the zero-center feature is not necessary, since a zero-set adjustment is provided in the meter circuit. To use a zero-left meter, simply adjust the zero-set until the needle rests in the center of the scale with the indicator disconnected from the adder and the R4 terminal of the indicator grounded.

The only critical part of construction and installation concerns R3—this resistor should be located right at the detector load resistor, and a shielded lead run from it to R4. The rest of the circuit can be an outboard unit. Power can be taken from any source capable of supplying 10 ma at 200 to 300 volts dc and 600 ma at 6.3 volts for the filament.

To use the S-Meter after it's built and installed, start by setting both the *coarse* and *fine* knobs to their zero settings. Turn the receiver to the band in use, and disable the AVC by switching to *manual*. Find a vacant spot on the band. Using the receiver RF and/or IF gain control, balance the S-Meter for a center-scale indication. This calibrates the instrument to the prevailing noise level for the band, the receiver, and the particular conditions at the time.

Now, secure the receiver rf or *if* gain control in position with a strip of masking tape. If it is moved, you'll lose calibration. Tune across the band to signals, and at each signal you want to measure, balance the S-Meter with the *coarse* and then the *fine* knobs.

Note that the *fine* knob provides only an increase, not a decrease, in indication. Start with both knobs at zero; the needle will be to the left of center. Increase the *coarse* setting until the needle moves to the right of center, then decrease the *coarse* setting one unit and center the needle with the *fine* knob.

When you have the receiver calibrated to the meter, you'll occasionally find signals which overload the set; if you take the time to calibrate the gain control as well, you can then back off and handle them too.

To calibrate the gain control, disconnect the receiver from the antenna and hook up a signal generator. Turn the gain control to maximum, and balance the S-Meter with the two knobs. The S-Meter reading is immaterial, but for convenience the signal generator should be adjusted so that the reading is somewhere between S-9 +0 and S-9 +6.

Mark this position of the receiver gain control "0". Next, set the S-Meter *coarse* control one unit lower; leave the *fine* knob alone. Using the gain control, rebalance the meter. Mark this position of the gain control "+1". Move the *coarse* control another unit lower and rebalance with the gain control as before, marking this position "+2". Continue in this fashion until the gain control is completely calibrated.

If you run out of range, losing the signal or going below "S-0" during this procedure, return to the last accurately calibrated position. Then move the *coarse* control back to S-9 and increase signal-generator output until the meter is rebalanced (you can use the *fine* control to rebalance after the signal generator output is in the right range). This establishes a new reference level, and you can continue calibration.

To use the calibrated gain control with the S-Meter, first proceed as before—tuning to noise, setting both *coarse* and *fine* controls to zero, and balancing with the gain control. Now, note the gain-control reading. When you run into a signal so strong that it overloads the receiver, back the gain control down an integral number of steps (if the original reading was +4½, you can back it down to +5½, plus 6½, +7½, but not to +7 or +6). Note how many steps you moved, and add this number of S-units to the strength you measure (if you moved down four steps and read S-9 plus 5, the true reading would be S-13 plus 5 or in more conventional terms, 30 over 9—but you won't find this kind of signal around).

. . . K5JKX/6

PARTS LIST

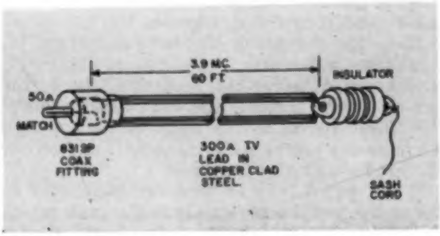
1 single-pole, 10-position rotary switch (COARSE Control)
1 1-megohm, linear taper potentiometer (R2)
1 5000-ohm, linear taper potentiometer (ZERO SET)
1 50-0-50 microammeter (Lafayette TM-13 recommended; any 50- or 100-microammeter will work)
1 9-pin tube socket
1 chassis box
knobs, panel decals, wire, and solder

LCU's Michigan Long Wire

Ralph Burch W8LCU

THE following antenna was designed to be used with a 35 watt, 75 meter station which I spent a great deal of time installing in my 1959 Shasta camp trailer.

The thing that really got me into trouble was falling over tent stakes and getting mixed up in campers clothes lines while trying to erect a 75 meter doublet in one of many Michigan parks. Right then and there I knew I would have to come up with a new approach on portable antennas.

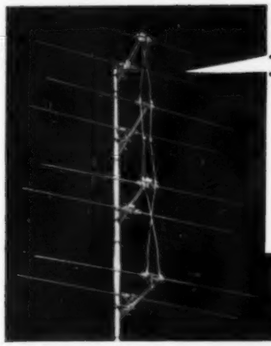


The antenna had to meet certain specifications:

No. 1. It couldn't take to much space.
No. 2. It had to be erected easily in a minimum amount of time.
No. 3. It must be supported at one end by the trailer making it easy to fasten the other end to some convenient tree, post, or mast.
No. 4. The antenna must be fairly efficient.

With this goal in mind, I set out to design what I call the LCU portable antenna.

This antenna consists of nothing more than a piece of copper clad 300 ohm TV ribbon cut exactly 60 feet long (for 3.9 mc). At one end the ribbon is fed into a standard coax fitting and one wire is soldered to the shield or ring.



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The other wire is fastened to the center. At the other end the ribbon is simply shorted together with an insulator installed (see sketch). Fastened to the insulator is about 30 feet of heavy sash cord.

On the trailer near the top on one side, I am using a 4 inch coax feed thru fitting. On the inside of the trailer I use approximately 3 feet of 50 ohm coax to get to the station. In addition to the antenna system, I have a small metal stake with a wire about 3 feet long and a battery clip fastened to the end.

Once I have arrived at the desired camp site and parked the trailer, all that is necessary is to screw the coax fitting on the feed thru near the top side of the trailer, pick out a convenient tree about 65 feet away, tie a pair of pliers or a weight on the sash cord, toss it up over a limb, pull the antenna tight, push the ground rod in and fasten the battery clip to radio ground. Then on the air I go.

In every case the antenna height should be 8 feet above ground at the trailer end and about 30 feet at the far end.

The antenna is essentially the same as a commercial Unipole which normally sets vertically with 4 radials at 90 degrees and the impedance match is approximately 50 ohms. This antenna works somewhat the same except it is erected horizontally. The return wire to ground lowers the ground resistance, causing the antenna to radiate more efficiently. This antenna doesn't radiate as well as a folded dipole, however, its efficiency is very close. At 3.9 mc the swr should be 1.5 to 1 or less.

Height has a great effect on the feed point impedance. In other words, if the antenna wire were raised at the feed end the swr might go up as high as 5-1. Whenever the antenna is used under the conditions listed, its efficiency is at optimum.

The same antenna could be used on many other frequencies, in fact it lends itself beautifully to 160 meter operation. The formula for figuring the length in feet for the 300 ohm ribbon is 234 divided by frequency in megacycles.

I hope this will give some of you fellows some new ideas on portable antennas. . . . W8LCU

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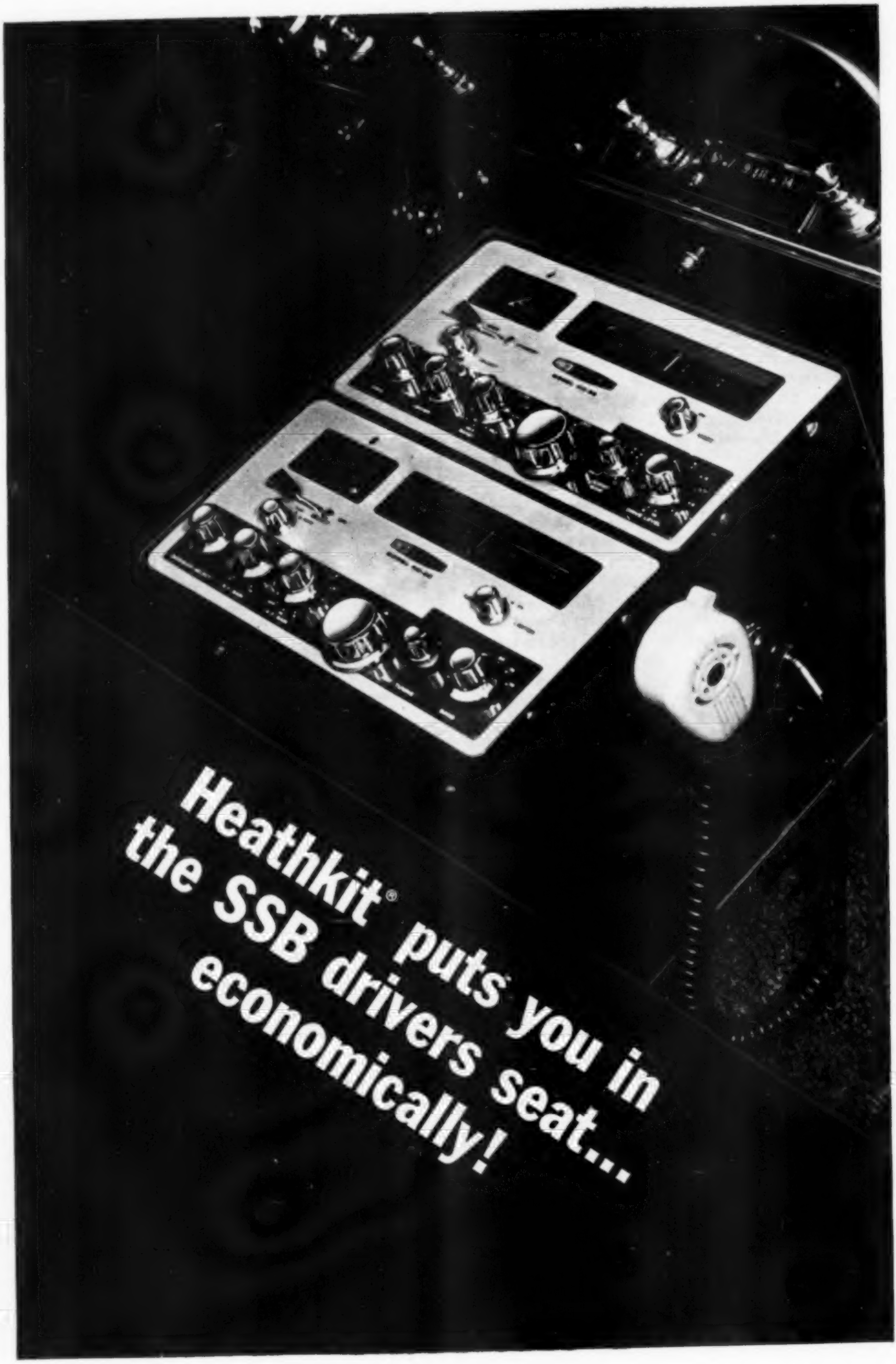
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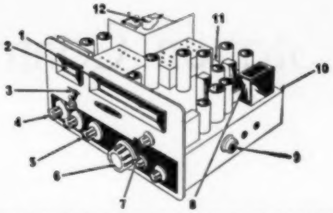

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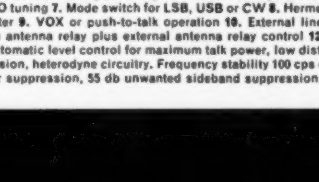

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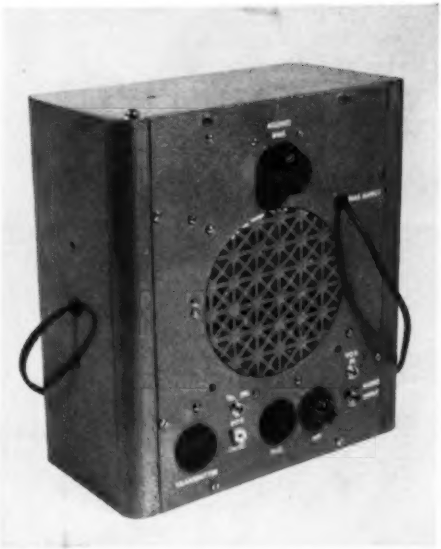

Fig. 1. 5" x 9½" x 10½" loudspeaker cabinet containing interconnecting circuitry for a ham station transmitter and receiver. The knob at the top is for adjustment of the operating bias for the transistor break-in circuit. The cord at the right connects the negative power supply which is used to cut off the TR switch. Across the bottom are: transmitter plug, bias jacks for the TR switch and final amplifier, accessory plug, receiver plug and, at the extreme right, the VOX input and audio input jacks.

Picture by Deane Bond

THE small size and relatively simple wiring layouts for transistors make them lend themselves to small equipment units without requiring special miniaturizing techniques. The station control unit shown in Fig. 1 is a good example. The speaker box, which is 5" x 9½" x 10½" in size, houses all of the accessories required to connect a transmitter and a receiver together to form a complete station, except a small bias supply and a TR switch. There is enough space left in the box for these also, if desirable.

The speaker box contains a 5" x 9" oval speaker, a W5LAN "Transistorized Electronic Key," (QST, May, 1959), an AC supply for the key, a "Break-In a la Transwitch" circuit, additional transistor circuitry to provide for VOX operation without relays and all of the necessary wiring to interconnect the transmitter and receiver.

Fig. 2 shows the interior of the box. The transmitter and receiver plugs are extended to connecting blocks to simplify inter-connection. The plugs and connecting blocks are attached to the removable back of the loud speaker cabinet. Jacks for taking cut-off bias to the TR switch and final amplifier make it easier to rearrange the station or to remove a unit for servicing.

Also fastened to the cabinet back is a home-

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made chassis on which is mounted the "Transwitch" circuit. A multivibrator circuit, connecting the transmitter "VOX" circuit to the "Transwitch" circuit, and a bias circuit for cutting off the final amplifier while receiving have also been mounted on the chassis. This circuitry will be the subject of a later article.

Notice the small line-to-voice coil transformer at the lower right. This is used to permit taking the receiver output through the "anti-trip" circuit in the transmitter at a 500 ohm impedance level, cutting it to 3.2 ohms for the speaker voice coil. This increases the amount of control available for adjusting the anti-trip feature.

Inside the speaker cabinet can be seen the "Electronic Key" unit and the loudspeaker. Out of sight at the right is a small 22½ volt dc supply for the "Key." This accounts for the power cord seen in Fig. 1. Controls for the electronic bug and the "Muting Level Control" are mounted on the face of the cabinet.

The construction of the unit is as simple as the pictures make it appear. There is plenty of space under the transistor chassis for all of the resistors, condensers and wiring for the circuits without crowding or creating difficult assembly problems.

The box is adequately ventilated to dissipate the small amount of heat generated in the circuits.

This unit was developed to permit using the main station HT-32 and SX-88 in our 23 foot house trailer for those times when weather or darkness keeps us off our favorite mountain lake. The whole assembly is powered by a light plant mounted in the trunk of our car. But that's another story! . . . W7AXJ

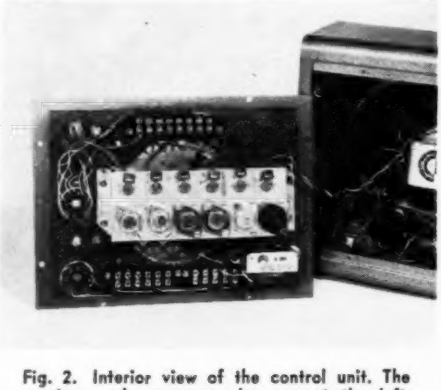

Fig. 2. Interior view of the control unit. The receiver and accessory plug are at the left, wired in parallel and extended to the connecting block at the top. The transmitter plug and connecting block, similarly connected, are at the bottom. The line-to-voice coil transformer is at the lower right. Across the middle is the transistor chassis. Inside the box can be seen the electronic bug components and the loudspeaker.

Picture by Deane Bond

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A Universal Antenna

and some Comparative Measurements

John Ellison W6AOI
1720 Holly Ave.
Capt. U.S.N. (ret.)
Menlo Park, California

THE designation of universal antenna has been applied to a variety of antenna configurations but invariably there are certain implied limitations which are inherent in the system. The antenna described herein is perhaps more justifiably entitled to the term of "universal antenna" from several viewpoints. Before enumerating them, let me hasten to disclaim any "exotic circuitry," "sophisticated configuration" or "technilogical breakthrough!" This is a review of a time-tested horizontal antenna system in the light of present day knowledge and equipment available to the amateur which can assure proper adjustment for maximum performance.

The designation of universal antenna is applied chiefly for two important reasons, first, the system may be operated with no compromise of efficiency on not only any amateur band from 160 meters to 10 meters but also on practically any other frequencies between the amateur bands, such as are used for Army, Air Force MARS and the Naval Communication Reserve. Second, the antenna can be erected on practically any residential lot and lends itself to nearly any conceivable topographical arrangements of trees, houses and the like. Considering these two reasons we note that perhaps the chief perennial problem that besets the amateur seeking a suitable antenna system is not lack of information but rather an excess of information, so much so that he can scarcely make a satisfactory selection in view of the different limitations of the various systems. Just to mention a few in passing (which will probably strike a familiar nostalgic note for many), system A requires the shack to be about mid-way between the skyhooks, system B requires bringing the antenna hot end through the house to the shack location, system C requires a good *short* ground connection (and the radio shack is on the second or third floor!) system D requires tuned feeders (which are invariably too long or too short) system E will work on only one band, system F requires a few acres, system G requires only one mast (about 100 feet high!) and so on. Everyone can recall going through this phase of deciding on what to put up and where. Most of our amateur heritage of antenna knowledge stems from the time when all transmitters were home-built, and band-switching transmitters were not too widely used. With such transmitters a single band or two band antenna was adequate. However, with the present day commercially built complete transmitters or kits, there exists a transmitter capability which cannot be exercised with many of the simple antenna systems in vogue. Even though the operator may confine his operations largely to one or two bands, he would like to "visit occasionally" on some of the other bands. He may also want to join the MARS or NCR nets, although this desire is frequently circumvented as much by the frequency limitations of commercially built equipment, as by inadequate antennas.

Suppose we start off in pedagogical fashion considering what we would like to have in performance versus what we can reasonably achieve. Consider first the question of antenna height. Height in absolute terms is necessary only to get reasonably clear of adjacent structures. With reasonable clearance of this nature, height becomes related to frequency and is more properly considered in fractions of wavelength rather than in feet. In terms of wavelength, if we want to get low angle radiation of 30° or less we have to get the antenna up at least a half wavelength above ground. It is immediately apparent that for 160, 80 or 40 meters we are not about to get up high enough with any supports that are economically or physically within the grasp of the average amateur. So we accept this fact and consider what we *can* get with limited height and we learn that the major radiation we will get is mostly high angle, 60° or more. Actually, this is *not* a serious disadvantage since it gives us fairly solid coverage within the range of most contacts on these frequencies, under average propagation and QRM conditions. By the same token, there is comparatively little directivity experienced so that for all practical purposes the antenna is omnidirectional. This feature is particularly attractive for Net operations.

Last but not least, there is considerably greater freedom from multipath transmissions (fading) with high angle radiation. On 20, 15 and 10 meters (when they are open) where long distance contacts are sought we would like low angle radiation, and at these frequencies a half wavelength or more in actual feet becomes quite reasonable. So in summary, we may properly conclude that an average height of 35 feet would be quite satisfactory for an all-band antenna, or even as low as 30 feet will not be unacceptable. This height is easily within the reach of any amateur in view of house and tree heights and economical telescoping TV antenna masts. This is one of those rare occasions where what we can attain within reason is just about what we would like to have.

Next let us discuss the questions of antenna location and length. These two must be considered together. Naturally, the antenna must be located reasonably in the clear if we are not to lose too much power by absorption in adjacent structures in the strong antenna field. However, clear areas may not accommodate the required length, and in many cases, the length required for a low frequency antenna just isn't available anywhere on the property. In these cases we are told that we can bend the low current ends without reducing the efficiency seriously, and thereby squeeze the antenna into the available space. Now, if it were possible to combine the bent end with the flat top to get the length and use the former as the feed system we would be getting closer to an answer. There are disadvantages in bringing the antenna end into the shack, but if we bring the bent end down to a matching network, several desirable aims may be achieved. We may bring the bent end down wherever it is physically and electrically most suitable, the bent end/feeder end reduces the linear space required for a given antenna length, the matching network may be connected at the bent down end where it is conveniently accessible for tuning and adjustment, the antenna can be tuned to any desired frequency or harmonic and the matching net can be fed with a low impedance line such as coax of any length running to the transmitter location.

Now that we have reviewed the general picture, let us get down to practical cases. First, it must be realized that this is a fundamental and harmonic operated antenna, and as such, has no gain over other fundamental or harmonic antenna types.

However, as distinct from many other types, it operates as a resonant system without compromise of efficiency on any frequency to which it is tuned, it may be conveniently and accurately tuned to any desired frequency and

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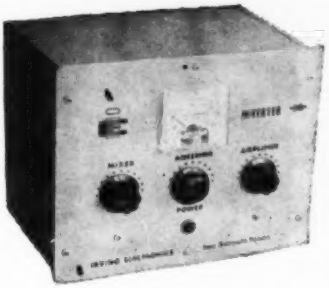

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it may be fed with a flat (non-resonant) line of any convenient length. This insures the maximum performance of the antenna as a radiating system and the maximum freedom from critical feeder lengths when changing frequencies.

The antenna height has previously been indicated as 35 feet. The over all antenna length should be chosen so that it is slightly short for the highest frequency we expect to use. The purpose in making the antenna slightly short is to permit resonating it to any desired frequency or harmonic with a loading coil only. If we just picked a random length we would find some frequencies where a series condenser instead of a series coil would be required. This would introduce an additional tuning element with no compensating advantage. So we make up a table using the Handbook formula for lengths at various frequencies.

$$\text{Length (ft)} = (\text{Number of half waves} - 0.95) \times 492$$

	Freq. in mc	
Freq	**Resonant Mode**	**Length inFt.**
3295	½ wave	142
4000	½ wave	117
7300	1 wave	131.5
7832.5	1 wave	122.5
14350	2 wave	135.7
21450	$\frac{5}{2}$ or 3 wave	113.5 or 136.5
29700	$\frac{7}{2}$ or 4 wave	115 or 131.7

From the above table we select the maximum length of our wire antenna as 113.5 feet and then reduce *that* figure by an allowance for the length of the ground lead and something for the resonating coil. Actually, in practice, it turns out that a length of about 105 feet is satisfactory, but it can be even less, realizing that a shorter length simply requires more turns on the resonating coil. This 105 foot length is the length of the flat-top portion plus the vertical portion down to the coupling network. If the vertical portion is 35 feet, we need a horizontal top of 70 feet. If space does not permit a 70 foot run, bend the far end down or sideways to get the required over all length. As you can see, the length is not too critical.

Resonating and Coupling System

The downlead of the antenna is tapped onto a coil which in turn is connected to the matching network. It will be necessary to be able to tap onto *any* turn of the coil for reasons which will be explained later. Hence, for the antenna coil a 38 turn coil, 3 inches in diameter at 8 turns per inch is used. This is half of a standard ten inch length of AIRDUX #2408 and with the 8 turn per inch pitch it is possible to clip on to any turn. There is one catch I should warn you about right here! Note that if a coil is at the very end of the antenna where it connects to the matching network the vanishingly small antenna current makes the coil inductance almost ineffective. But if we put the coil *in* from the antenna end a few feet we have moved up on the antenna current curve sufficiently to get an inductive loading effect with a reasonably small coil. In the actual antenna herein described, the 38 turn coil (52 microH) and a 3 foot lead from the coil to the coupling network made a suitable combination.

The coupling network is an L net which must match the end impedance of the resonated antenna to the impedance of the coax feedline. An L net is the simplest and most efficient form of impedance matching known but as a rule it is not a trial and error device. Usually, the two impedances to be matched must be known within a few percent, whereupon the calculation becomes very simple. For the sake of completeness, I am going to digress briefly on the subject of end impedance of a resonant antenna system. This is not a rigorous approach nor on the other hand is it "cracker-barrel" theory,—let's call it a median approach. The technical literature is quite vague on the subject at hand unless you have infinite time and unlimited access to all printed matter. The value of the end point impedance is affected by the height above ground, wire size, proximity to structure, antenna configuration, mode of operation and other variables, —probably including "Murphy's Law." With so many intangibles to reckon with, the best we can do is to take a statement in the reference books that tells us that for a half wave antenna a quarter wave above ground the end impedance is on the order of 15,000 ohms. As the frequency is raised the physical height in terms of wavelength changes and the impedance becomes less, the minimum value being on the order of 3000-3500 ohms for wire antennas. This is of interest only when making the first approximations to get started on the L net design. From experimenting with this antenna to achieve a practically perfect match, and then from the net values working backwards to calculate the antenna impedance, it appears that the maximum value (which occurs at half wave operation at the lowest frequency) is between 9000 and 10,000 ohms. This means in actual practice, that the L net constants for all our purposes can be met with a multi-tapped coil whose maximum inductance is about 45 micro-henries and a variable condenser with a 20-120 mmf. range.[1] The remaining half of the 10 inch length of AIRDUX coil will do admirably for the L net inductance and should have about 12 taps run from it to a switch. One word of caution,—the end voltages are high! The condenser should have spacing for 1500 volts for medium power rigs and 2000 for high power rigs and the switch should have comparable insulation. The coil should be tapped to short out turns from the maximum value about as follows:

Table 1.

Tap	Active coil turns	Approximate band suitability
1	whole coil	
2	29	80 meter
3	25	80 meter
4	21	
5	16	40 meter
6	14	40 meter
7	12	
8	6	
9	5	20 meter
10	4	20 meter
11	3	15 meter
12	1	10 meter

The antenna coil taps may vary considerably from one installation to another because the antenna end impedance will vary with the local installation conditions but in general they will follow this pattern:

Table 2.

Freq.	Active coil turns
3.3	38.5
3.6	36.5
3.8	36.5
4.0	36.5
7.15	17.5
7.83	12.5
14.3	8.5
21.3	3.5 or 9.5
29.0	1.5 or 7.5

Tuning and Adjusting

The antenna, network and transmitter are connected together as shown in Fig. 1.

Since we do not know the end point impedance of the resonant antenna at the various frequencies we have to get the proper match indirectly. We do know, however, that there are three points on a resonant antenna where the current and voltage are 180° out of phase, namely, at the middle of a current loop and at the ends of the antenna. At these points, and only these points, can we get a purely resistive load, without providing some reactance compensation in the coupling device. So, to get the antenna resonant we use a SWR bridge or preferably a reflected power meter (or directional coupler, as it is also called) in the coax line. Then, if we can effect a proper impedance match the transmitter will load to its proper value.

---

1. For theory of L net design see GRAMMER, QST, March 1957. For practical application to antenna matching see my article CQ, July 1960.

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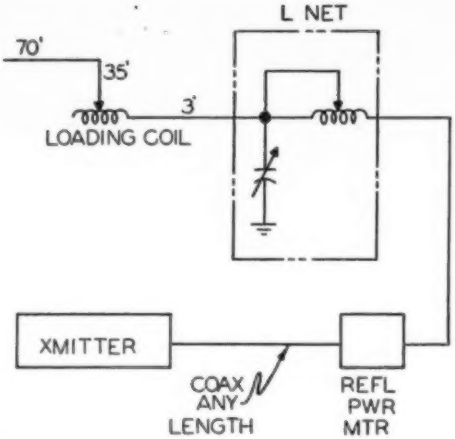

Because of interaction among the various elements of the system, the following adjustment method is recommended as the simplest and most foolproof. Since the L net acts not only as an impedance matching device but is also capable of compensating to a minor degree for a reactive component in the antenna it is necessary first to have one part of the entire system accurately and finally set, and second to have a means of measuring power transfer. The one part that must be set first is the transmitter. It must be tuned up to a *non-reactive* load (resistors only!) and its control settings logged and kept constant while the remainder of the system is adjusted. You understand, of course, that this procedure is necessary only when making the first adjustments of the entire system. Once the settings of taps, condensers, controls, etc. are found they can be recorded and thereafter changing bands is quick and accurate,—and dependable. This eliminates, permanently, the oft-repeated phrase on the air, "Just a moment while I dip my final tank." This is not only unnecessary but if resorted to will definitely "louse up" the entire system. This may come as a terrible blow to the characters who like to "peak it up a bit." The second step requires *as an absolute necessity*, a reflected power meter. Either buy a kit or build the one in the late ARRL Handbook. The latter is simple and easy and inexpensive, and may be left in the line as a continuous monitor.

The actual detailed steps are, first, tune up the transmitter to the dummy load of 52 ohms. You can and should use reduced power for this tune up as long as you maintain the ratio of plate voltage to plate current the same as it will be at full power. This maintains a constant "generator impedance" from the final into the transmitter coupling system to the coax line. Next, couple up the transmitter to the coax line, coax line to the L net and L net to the antenna and loading coil. Set the L net inductance tap and the antenna coil tap from tables 1 & 2. Set the reflected power meter to read reflected power and the transmitter at reduced power and tune the L net condenser through its range while observing the reflected power. There will be some setting where it will be lower than anywhere else. Then add or subtract antenna coil turns, retuning the L net condenser each time, until the reflected power goes practically to zero, which it will at some setting. This establishes antenna resonance for that particular frequency,—all your power is going out. Then check the transmitter loading at normal power input. If it is low or high, reduce or increase the L Net inductance and retune the L net condenser for minimum reflected power. This establishes the proper impedance match to give proper transmitter loading. The question may arise regarding the use of a Pi net or link coupling between the antenna and the coax rather than the L net. Calculations will show that since an L net is a rudimentary Pi net (one condenser having zero capacity) any other Pi net will of necessity have a higher Q than an L net. Since the high impedance transformation already requires a high Q, we would prefer a system which has the least "high Q" to obviate retuning within a band, —this dictates the use of the L net. The mechanical considerations, inflexibility and unpredictability of link coupling rules it out completely for this use. Another word of caution on constructing this antenna system. A moment's consideration will make it immediately apparent that the 3 foot length of antenna between the loading coil and the L network will be extremely sensitive to any physical movement since it has a small capacity to ground which in effect is "tuning" a large inductance. Any shift in position of the 3 foot length will throw off all your various band settings. You can avoid this by using a rigid rod (such as a 3 foot length of one-eighth brass brazing rod) mounted on stand-off insulators between the antenna loading coil and the L network. If this is done before any tune up measurements are made you will avoid a lot of trouble. This effect we are dodging is similar to the detuning effect of the swaying tip on a mobile antenna.

Operation

Because the antenna is loaded with lumped constants, the Q is higher than with a conventional full length wire antenna. This means in practice that retuning will be required if the percent frequency change is large, such as when going from one end of the 80 meter band to the other. However, not many transmitters will accept such wide frequency changes without retuning, either. You will find when using this antenna for receiving, that the high Q is a distinct advantage as it peaks up noticeably those signals which are in the

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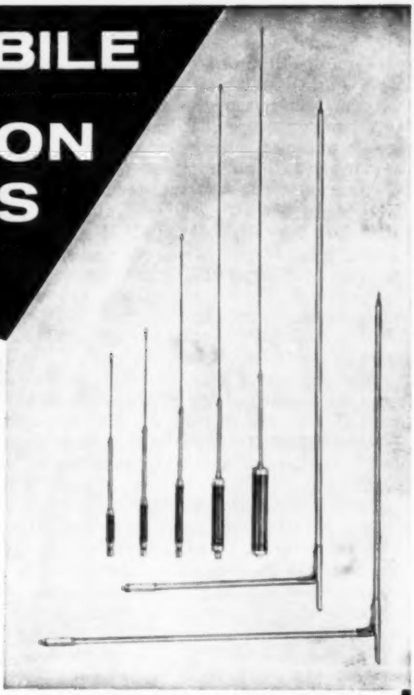

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NEW-TRONICS DIVISION 3455 Vega Avenue • Cleveland 13, Ohio pass band. Also, in retuning from say 3.5 kc to 3.9 kc it is possible to change either the antenna loading coil or the L net condenser. It is easier in practice to find one antenna coil tap for an entire band and use the reactance compensating feature of the L net which occurs automatically when retuning the L net condenser for minimum reflected power.

The use on 160 meters has been deliberately avoided up to now because it differs from the procedure on all other bands. For 160 meters simply by-pass the L net completely and connect the coax between the antenna loading coil and ground. This operates the antenna as a quarter-wave grounded antenna and the loading coil will permit tuning over a wide range from about 1650 kc to about 2200 kc. The SWR will not be over 1.5 to 1 on this band. On this band the quality of the ground system assumes some importance but on the higher bands the ground is relatively not important because the end current is so small that the power loss is practically nil.

One point of discussion remains, namely, the mixed polarization resulting from the fact that both vertical and horizontal portions of the antenna radiate. This may disturb some of the purists but for my part I find it not objectionable. It helps on some close-in contacts where transmission is by the direct ray path, and in cases of ionospheric reflection, both waves come down horizontally polarized in any case.

Comparative Tests

Now, since the ultimate proof is in the performance of the antenna in question, some comparative tests were run and are described below. No serious minded amateur is going to be content with mere impressions collected over a period of time when there are so many variable factors impossible to evaluate. I have in operation a 40 foot vertical that has been giving satisfactory service on frequencies from 3295 kc through 7832.5 kc over a four year period. It was decided to test the horizontal versus the vertical under as near identical conditions as possible. While this does not give an absolute measure of performance, it does give a comparative evaluation. A test was run on an A.F. MARS net on 3295 kc at night and another test was run on a different day net on 7832.5 kc. The test conditions were:

1. The transmitter was first loaded up to a 50 ohm resistive load to determine proper tuning, and thereafter the tuning controls were kept at the loading settings.

2. Each antenna was tuned up with its own coax feeder to show less than 1% reflected power (better than 1.2 to 1 SWR).

3. Each observer set his receiver rf gain at a level to give about half-scale reading on his S meter and did not touch any tuning control or gain during the test.

4. A two minute transmission was made on one antenna while the observers noted the average signal strength on their S meters.

5. The coax feedlines were shifted and a two minute transmission was made with the second antenna.

6. Each station then reported S meter strength for each antenna. *Absolute* S meter readings have little significance since they depend on location, receiver settings, receiver type, etc., but when normalized (i.e. reduced to a common base) they permit a direct comparison of the two antennas under as near identical simultaneous conditions as is possible to create. The significance of this is that since these were *comparative* tests, the same *comparative* performance might reasonably be expected at any location. For the night test on 3295 kc there were 12 stations reporting within a 70 mile radius and 3 stations at 350 miles. All stations reported better signals from the horizontal antenna and were reasonably consistent in an average advantage of 6-12 db in favor of the horizontal. For the daytime test on 7832.5 kc there were 25 reporting stations over a 500 mile radius. Most of them were within a 350 mile radius and their average report was a 12-18 db advantage in favor of the horizontal antenna. Those few stations around 500 miles reported that the two antennas were about equal. One other significant point in both the day and night tests was that nearly all stations remarked that signals from the horizontal antenna were much freer from fading or flutter. Only a few stations in either test were close enough to be receiving a direct signal so this represents nearly all skywave transmission. To avoid any possibility of the "brute force and ignorance" method overcoming antenna performance, these tests were run with a low power transmitter with a plate input of 95 watts. Because there were no operating nets on higher frequencies, no similar comparative tests were possible but the antenna has been operated on both 14 and 21 mc bands, when openings permitted, and the performance has been equally satisfactory.

As you may have surmised by now, this antenna was investigated primarily for the purpose of finding a system that would be completely satisfactory for several widely separated A.F. MARS frequencies as well as for the amateur bands. In this regard it has performed with considerable success, permitting rapid reliable shifts between bands with complete confidence in efficient operation and proper transmitter loading. However, the proven versatility has made it highly attractive for strictly amateur band use.

Credit must be given and acknowledgement is made for the assistance rendered in making the comparative tests by many of the members of the Conac West Coast Central division #2 and the members of the A.F. Western Technical Net. . . .W6AOI

One Tube VOX

Fred Cupp, K8AOE

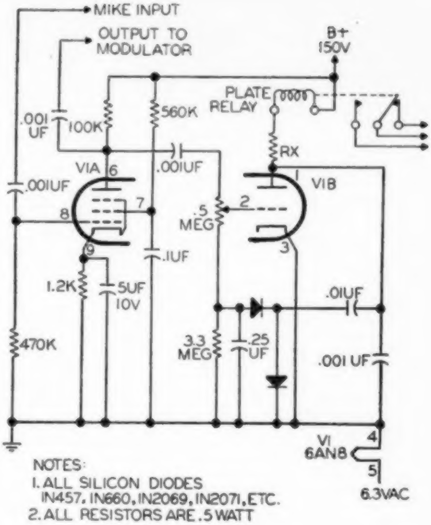
For some obscure reason unknown to this writer, VOX operation seems to be used only by the sideband operators. VOX operation however is very practical for other modes and has been used with excellent results by the author for AM, FM, and MCW on six meters for at least six months. Perhaps the complexity of most VOX circuits drives operators away, so here is a simple yet effective VOX using only one tube which acts as the mike pre-amp as well as the VOX.

The schematic diagram and parts values are shown in Fig. 1. V1a, one half of a 6AN8 is used as a conventional pentode audio pre-amp. The audio signal is coupled from the plate to the gain control and following stages of the modulator. The audio signal is also coupled into the .5 meg VOX Trip Level potentiometer. Audio from this pot is fed into the grid of V1b, the triode section of the 6AN8, and is amplified, appearing across the plate load resistor and relay. The audio is coupled from the plate and then rectified by the silicon diodes and charges the .25 mfd storage capacitor. This negative dc voltage is applied to the grid of V1b through the trip level potentiometer, thus changing the operating point of the triode. This reflex action allows the relay to de-energize thus turning on the transmitter.

This reflex circuit as it is known may be familiar to radio control model enthusiasts, as many R. C. receivers use this principle. The values in this adaptation have been optimized for use as a VOX circuit, however if the builder wishes to have more knobs to twist, the resistor across the storage capacitor may be replaced with a 5 meg. pot. This will allow the operator to set the amount of time delay after he stops speaking.

Any plate relay of greater than 4K ohms resistance may be used in this circuit, and resistor Rx should be selected to give reliable pick-up of the relay with no audio input. With less sensitive relays it may be necessary to eliminate the resistor completely and also raise the plate voltage to get sufficient current. Be sure however to stay within the maximum current ratings of the tube. With a Potter-Brumfield #PW5LS, 10K ohm relay, Rx was 47K ohm. Germanium diodes such as the 1N34 or 1N38 will not work in this circuit as their reverse leakage is excessive. Silicon computer diodes such as the 1N457 or 1N660 are excellent but expensive. A very satisfactory compromise is the power silicon diode types 1N2069 through 1N2071. These have much greater current ratings than necessary but are quite inexpensive and work very well.

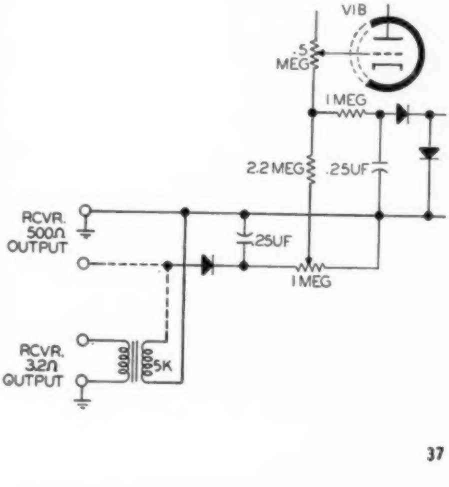
Fig. 2 shows the modifications necessary to add anti-vox to prevent receiver noise picked up in the mike from tripping the VOX. Audio from the receiver output is rectified positive and bucks the voltage from the VOX rectifier, thus preventing operation of the relay due to receiver noise. If your receiver has a 500 ohm output it may be applied directly to the diode as shown, or a 3.2 ohm speaker output may be stepped up with a small ac-dc radio type output transformer.



NOTES:
1. ALL SILICON DIODES IN457, IN660, IN2069, IN2071, ETC.
2. ALL RESISTORS ARE .5 WATT

As with any VOX controlled station, the operator will have to condition himself to ignore the relays clicking in and out and also avoid the habit of saying, "Ahhh—Ummm—and Uhhh—," in an attempt to keep the station on the air when in reality he has nothing worthwhile to say but won't admit it. Just think how much quieter the band would be if VOX operation was mandatory!

. . . K8AOE



Check Quartz Crystal Activity and Frequency

Adam McLaren W0CGA
213 South 16th St.
St. Joseph, Missouri

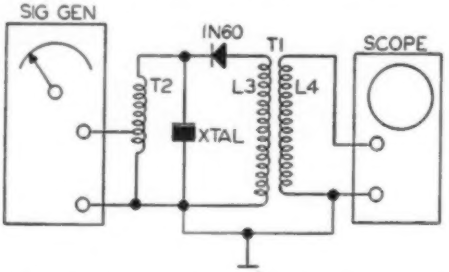
As solid state electronics is becoming increasingly important in today's equipment it is well to know all we can about testing and using such materials.

Quartz crystals are being used in many more ways than formerly and in so many different modes of operation that a simple method of testing them is needed.

Only a minimum of equipment is needed for preliminary checking activity and fundamental frequency operation. For more extensive mode of operation and higher mode functions a high gain scope is required.

For preliminary checking the circuit of Fig. 1 is used, a pair of headphones is connected across the output of T 2 in place of the scope. The signal generator can be the usual service generator.

A modulated signal is used and the generator is tuned to the approximate supposed fundamental frequency. These frequencies usually will be below 10 megacycles although crystals are made for frequencies higher than this.



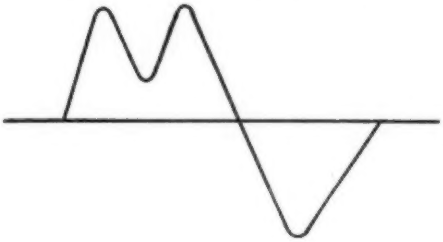
The audio frequency tone from the signal generator will change as the generator signal is tuned across the frequency of the crystal. The tone will also change at the harmonic frequencies of the signal generator but the amplitude will not be as great and drops off rapidly as the harmonic frequency becomes higher. This of course means tuning the generator to frequencies lower than the fundamental of the crystal. All harmonic frequencies of the signal generator will be found in this test and will be exact submultiples of the crystal fundamental frequency. Dividing the fundamental crystal frequency by 2-3-4 and etc. will indicate the fundamental frequency of the signal generator. Thus if a crystal of known accuracy is employed it can be used to calibrate the accuracy of the generator at frequencies lower than the crystal frequency. This of course works both ways and if a generator of known accuracy is used it can be used to accurately indicate the frequency of the crystal. If a high gain scope is used instead of headphones harmonic frequencies of the generator as high as the 10th. will be indicated.

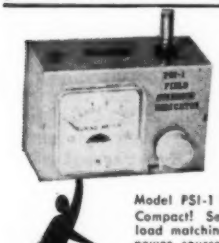
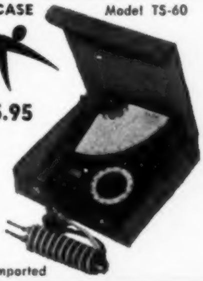
When a crystal oscillates on an overtone it breaks down into layers and oscillates at odd harmonics of the fundamental. Multiplying the fundamental frequency by any odd number indicates the frequency of the higher mode at which the crystal will oscillate. Thus a 3910 kc crystal operating in the 3rd. mode would be 3910 kc multiplied by 3 equals 11,730 kc. Overtones are seldom exact multiples of the fundamental frequency. Ordinary crystals will usually operate very well on the 3rd. mode depending on the type of holder. Crystals ground for higher order mode operation will usually show greater activity at all higher modes.

For indicating higher mode operation of crystals the scope must be used. The indications on the scope show a notch in the sine wave pattern in much the same way as in receiver filter circuits. These points are very sharp and may be passed over if the generator is not tuned slowly.

The activity factor of the crystal is indicated by the depth and sharpness of the notch. A good active crystal will pull the notch down to almost the zero voltage line. Fig. 2 shows the sine wave with the notch shown in the first half cycle of the scope pattern.

To check a crystal of unknown frequency tune the generator over a band of frequencies in which the crystal frequency is suspected to be. If an indication is found note the frequency and if this is the fundamental the next lower frequency of the generator at which an indication will be found will be one half the first frequency noted. Also if this is the fundamental frequency the next higher frequency at which an indication will be noted will be three times the first indication, or the 3rd mode. If this is true other indications will also be found at five or seven times the first frequency. Note that frequencies above the fundamental will never be indicated at 2-4-or 6



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times the fundamental frequency.

For instance a fundamental frequency of 4 megacycles will have indications also at 12-20-or 28 megacycles. Also below the fundamental frequency, indications will be at 2 megacycles, 1,333.3 kilocycles, 1000 kilocycles and etc.; these being the harmonic frequencies of the generator.

Tuning the generator through the different bands of frequencies going higher in frequency a point will be found where the next higher frequency indication will be 3 times the frequency of the point before mentioned. This last is the 3rd harmonic and the point first referred to is the fundamental frequency. A very slight indication may be found between the fundamental and the 3rd mode frequency. This is due to the 2nd harmonic of the generator exciting the crystal on the 3rd mode and can be ignored.

Also note that if the fundamental frequency is 4 megacycles and the 2 megacycle point had been found first then the next lower frequency indication point will not be 1 megacycle but will be 1,333.3 kc and the next lower frequency indication will be 1 megacycle. This shows that the 2 megacycle point was not the fundamental.

All this is much easier to do than to explain but simply by tuning the generator through the different frequencies watching for the stronger blips and making a few mental calculations as you find the different points it becomes easy to check a crystal in all its modes.

The coil T 2 in Fig. 1 works well at frequencies from 400 kc to 20 megacycles. It was found quite critical and dimensions should be followed closely. . . .WøCGA

Sig. Gen.—Usual service signal generator.
T2—11 turns #20 cotton covered wire, tapped at center on 2.5 inch form.
T1—4 to 1 audio interstage transformer.
L3—Primary.
L4—Secondary.
Scope—High gain.

Letter

Dear Wayne:

It isn't often that I drop people a line voicing my opinion, but a recent article in the February edition of 73 demands response.

I want to express my thanks for printing Paul Barton's article on FINAL TANKS on page 12, etc. This is the kind of technical information that I crave for, and you have made one ham very pleased. Convey my best regards to W6JAT, assuring him that K2SKK has read it all and is putting this to good use. In my estimation, this article was worth the entire year's subscription; anything else you print as good as that will be "ice cream & cake" for me!—For second choice, I enjoyed WA6QFD's article on Silicon Rectifiers, p. 38. Keep up the excellent work!

Bon voyage to you and the XYL on your forthcoming trip to West Germany et al. Drive that Porsche carefully; we want you back to keep 73 going!

100—27!

Paul Boivin, Jr., K2SKK

Before the Breadboard

Staff

IF the response to our articles means anything, we hams are building equipment again; receivers, transmitters, test equipment, station accessories, you name it and chances are that somebody is working on it right this minute.

This is a wonderful situation; we like it! But the average response to a 73 article shows something else, too, which we find a bit disturbing: many of these people who are building gear now have an alarming lack of knowledge about the fundamentals of circuit techniques.

It's not really their fault; just about the only place to get these fundamentals is from an engineer (or material written to be read by an engineer) and all too many professional-type engineers seem to believe that these details cannot be communicated in anything but engineeringese—which leaves us poor hams out in the cold unless we happen to be technical translators.

Naturally, after hearing all the high-level talk about the difficulties of original design, we as neophyte designers begin to get the idea that it's a difficult project; the vicious circle is complete, and we stay in our somewhat befuddled state, believing that the art of original design is far too complicated for us.

"T'ain't necessarily so," in the words of the song. Sure, original design of a completely reliable communications system capable of handling 512 independent messages at the same time, on the Earth-Moon-Earth circuit, may be a bit beyond our capabilities. But not *all* design work is difficult; most of it is simpler than you think.

And if you think that any sort of understanding of the basics of circuit design are beyond you, take a look at Fig. 1.

Simple, isn't it? Just three resistors in series. But let's look at this circuit a bit, and study it.

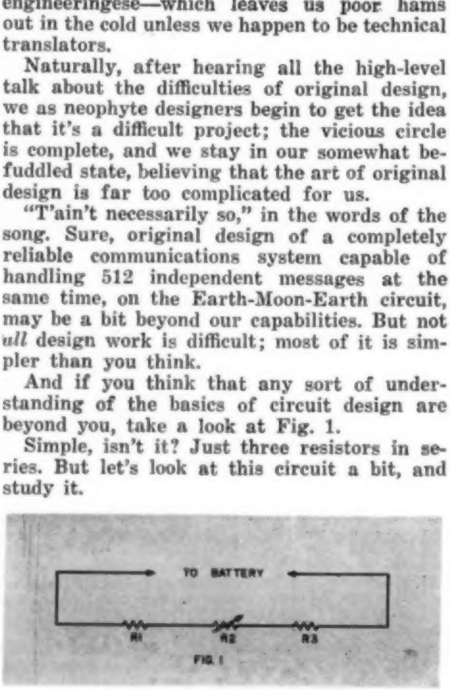

Fig. 1 Class A Circuit.

Since the three resistors *are* in series, all the current which passes through any one of them must pass through the other two. Since there are no other components in the circuit, the total voltage drop across the entire string must be equal to the total voltage applied to the circuit; there's no place else for it to go.

That's simple enough, isn't it? Yet the two sentences of the preceding paragraph state the two fundamental laws of network theory (usually considered the exclusive domain of the BSEE). "All the current that flows into a series junction between two circuit elements must flow on out" is the current law, while "the sum of the voltage drops across circuit elements in series is equal to the applied voltage" expresses the voltage law.

All very interesting, you may say, but what earthly good are three resistors in series to me in the design of a circuit? Let's take another look.

Suppose that the center resistor of the string were a variable resistor instead of having a definite fixed value. Suppose, also, that a constant-voltage battery were hooked up across the entire string. Finally, suppose that R1's resistance were considerably lower than that of either R2 or R3, and that the values of R2 and R3 were approximately equal. Now, let's examine the voltage acoss R3.

With R2 set for maximum resistance, the voltage across R3 would be just less than half that of the battery. Resistor R1, with its low value, would drop some of the supply voltage, but most of it would be divided equally between the two larger resistors.

If R2 were set for minimum resistance, on the other hand, the voltage across R3 would be almost equal to the battery voltage.

Now let's suppose that we have a trained Mongolian Midget operating R2; our Midget cranks the value of R2 up or down instantaneously according to prearranged signals we give him. The voltage across R3, naturally, varies in perfect step.

If the signals we send our Midget are very small voltages, and if the battery voltage is very large, the voltage across R3 will also be large—and you might say we have an amplifier.

This amplifier, of course, depends for its operation on a very special kind of Mongolian Midget—you might say, a Mythical Midget.

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Except that he isn't mythical at all; you can purchase him outright for less than a buck anywhere. What's more, he comes complete with variable resistor. Our Mythical-Midget-resistor combination is nothing more nor less than the conventional electron tube; the cathode-to-plate resistance is the variable resistor, while the grid is the midget.

In the electron tube (and also in the transistor), the operating technique is exactly the same as our three-resistor circuit of Fig. 1. The tube itself corresponds to resistor R2; R1 represents the internal resistance of the power supply (this is what makes the voltage drop as you increase the load; the smaller it is, the better); and R3 is the load resistor.

You can see from the three-resistor circuit that the output voltage available is directly dependent on the value of R3; the larger R3 is, the larger the output voltage will be. In no case, though, can output voltage swing farther than the original supply voltage (except in the case of inductive coupling, which is a bit complicated for this stage of the game).

Electron-tube circuits work the same way, with one important addition: since a certain amount of current is required by the tube, R3 cannot be too large. If R3 is made too large, the tube will be starved and will fail to operate properly. But within this limit—and it's wide—the gain will go up directly as the load resistance is increased.

If, at this point, you're thinking it can't possibly be this simple, you're only half right. Actually, you can make almost any tube do almost anything you want with no more information than that already given—but that's doing it the hard way, and may prove to be a bit costly if it takes you five or six burned-out tubes to find out just what values are permissible for R3.

To avoid this problem, manufacturers make available "characteristic curves" for their tubes. Every tube has a number of unique characteristics, mostly determined by the spacing and type of grid structures inside the tube. Any or all of these characteristics may be measured, and the results presented either as tables or as graphs in which key characteristics are presented together.

The most common means of presenting these characteristics is graphically, using what is known as the "plate family" of curves in which plate current is plotted against plate voltage, for certain fixed values of screen and control-grid voltage. Such a curve, for a type 12AU7 triode, is shown in Fig. 2.

From this graph (commonly known simply as the tube curve), you can determine the value of the tube's resistance (R2 in Fig. 1) in ohms by applying Ohm's law to the values of voltage and current which intersect at a

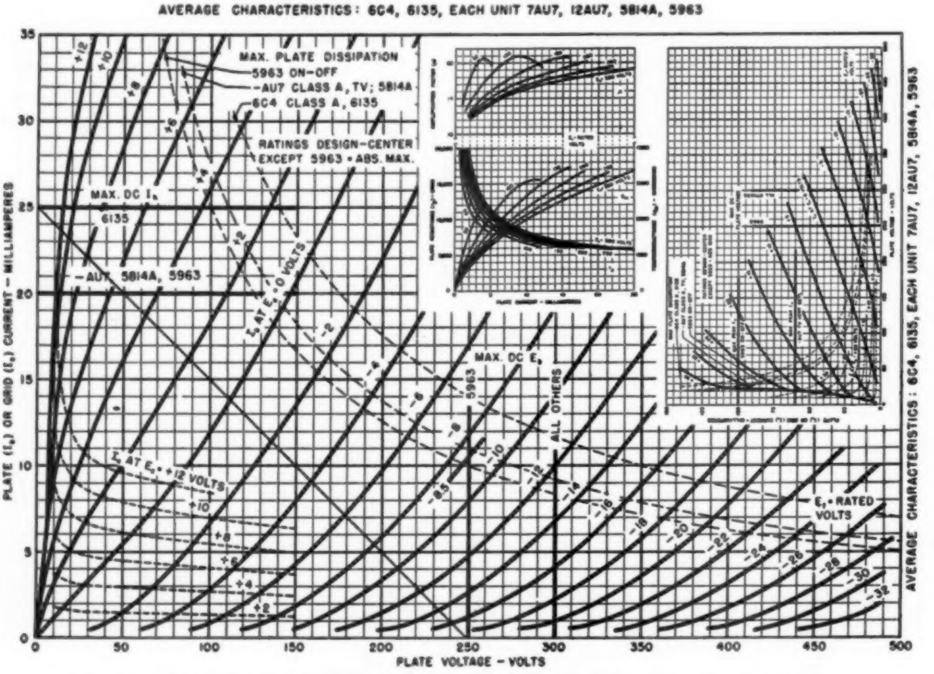

Fig. 2 Typical Plate-Family Characteristic Curves for 12AU7. Sample Load Line (10,000 ohm resistor

given grid voltage. For instance, if plate voltage is 150 and grid voltage is —2, the curve tells us that plate current will be 13.5 ma. Since resistance is equal to voltage divided by current, the resistance equivalent to R2 would be 150 volts divided by 0.0135 amperes, or 11,100 ohms.

It would be possible to use this procedure to determine the values of R2 over a wide range of voltages, then choose a fixed value for R3, and come up with an amplifier circuit —but such a set of calculations would be tedious. Since all the information we need about the tube is already shown in graphical form on the characteristic chart, it only makes sense to continue the design by graphic methods. This approach almost completely eliminates arithmetic, and rapidly produces a design.

The heart of the graphical design procedure is an item called a "load line." This is simply a straight line drawn on the chart through all the positions whose voltage-current relations come out to the value of R3, the load resistor.

Note that we said it goes through "all" the positions; however, you don't have to calculate them all. Since the resistance is fixed, the line will be straight—and this means that only two points need be calculated. Two points which are exceptionally convenient to calculate are those at which voltage equals zero, and at which current equals zero. If you know the value of supply voltage, this means that only one calculation is necessary; when current equals zero, voltage will equal that of the supply, but when voltage equals zero, current will equal the supply voltage divided by the value of R3.

To put this procedure into step-by-step form, first choose the tube you're going to use and obtain a chart for this tube type. Next, pick the supply voltage. Third, select a trial value for the load resistor (remember that the higher the value of the resistor, the greater the gain). Fourth, draw a dot at the point where the voltage line corresponding to the supply voltage intersects the zero-current line. Fifth, calculate the value of current when voltage is equal to zero, and place a second dot where this value of current intersects the zero-voltage line. Finally, using a ruler or straightedge, draw a line connecting the two dots.

What do you have, now? Basically, you have plotted the possible operating points of the tube. Let's do an example before discussing how it works. Since we have already used the 12AU7 curve, let's use it again. Pick a supply voltage of 250, and a trial load resistor of 10,000 ohms. The value of current at zero voltage will then be 250/10,000 ampere, or 25 ma, and we draw the load line connecting 25 ma at 0 volts with 0 ma at 250 volts as shown in Fig. 2.

Now, looking at Fig. 2, let's see how this works. Assume that the grid voltage is zero. The tube (if R3 were not in the circuit) would try to draw a large amount of current—but the load line shows us how R3 limits the current in the series circuit, and the operating point for the tube and R3 together is thus the intersection between the 0-volt grid bias curve and the load line itself, or a plate voltage of 110 volts and a current of just under 14 ma.

Since most amplifiers don't work right when the grid voltage goes positive, it's usual practice to bias the grid negatively so that incoming signals (which alternate on either side of zero) won't drive the grid positive, ever. Let's see what happens when we put 2 volts negative bias on our circuit.

The first thing we see is that our operating point has shifted. It's now fixed by the intersection of the load line and the —2 volt bias curve, at a plate voltage of 135 volts and a plate current of 11.5 ma. This means that, going back to the simple circuit of Fig. 1, 11.5 ma is flowing through the entire circuit. This current through the 10,000 ohms of R3 develops a voltage drop of 115 volts, leaving 135 for the tube itself—which checks with our earlier figures (we omit the voltage drop in R1 as negligible—and hope that it really is).

Now, let's put a 4-volt peak-to-peak signal in at the grid of the amplifier we're designing. On the positive half-cycle, this input signal will reduce the grid bias to 0; plate voltage will swing down to 110 volts as the current through the tube increases. On the negative half-cycle, grid bias is increased to —4 volts. The load line tells us that plate voltage at this point is 160 volts, with a current of 9 ma.

Thus, the 4-volt input signal has resulted in a change of output voltage between the limits 110 to 160 volts, or a 50-volt output swing. To determine the gain, divide the output voltage swing by that of the input voltage—in this case, it's 12.5.

So far, we've examined only the gain; the amplifier may produce plenty of gain yet not be usable because of distortion. We'll go into that in more detail before long, but at this stage you can make a rapid check by comparing the gain on positive half-cycles with that on negative half-cycles.

If these two half-cycle gain figures are the same, the chances are the amplifier's distortion will be low.

In our example, the positive half-cycle gain was 12.5, corresponding to an output-voltage swing from 135 to 110 for a 2-volt input change. The negative half-cycle gain, also, was 12.5 (swing from 135 to 160 for similar 2-volt input). Distortion probably will be low.

This load-line technique is valuable in the design of audio amplifiers; it works just as well for low-level amplifiers and for high-power modulators. You can even make it work for push-pull circuits, but those are a bit beyond the scope of this article.

Naturally, this is not the only approach to amplifier design—just the simplest. The graph-

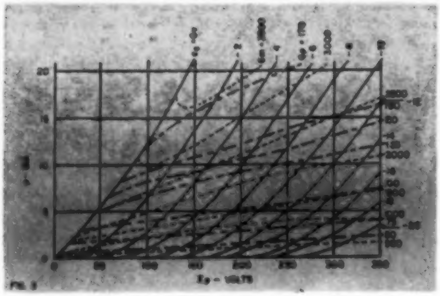

Fig. 3 G-Curves for 12AU7.

ical technique eliminates all algebra and higher mathematics usually associated with circuit design. However, if you feel that it's *too* simple this way, you can use the standard gain formulae and techniques to be found in Eastman's book (or almost any other handbook). A completely different approach, which includes many practical effects ignored in the conventional design technique, is to be found in Pullen. Pullen's technique, for instance, is the only one commonly available which allows for the effects of cathode resistors, loading of the next stage, and variations between tubes of the same type—but it *does* require algebra and the ability to plot your own tube curves, since he uses "G-curves" which manufacturers don't furnish. A G-curve for the 12AU7, which may be compared to the conventional curve, is shown in Fig. 3. Don't let it scare you.

A few paragraphs back, we promised some more words on distortion. Here they are.

The cause of distortion in an amplifier is simple: the gain of the stage changes as the input signal varies. If the change in gain is small, the distortion is unnoticeable; if the change is large, the distortion becomes obvious.

To calculate the precise amount of distortion produced in a stage, we have to know the precise amplification at the positive and negative peaks of the input signal—and this in turn requires the exact techniques of either Pullen's procedure or the conventional mathematical approach.

However, for our purposes we can do quite well by comparing the average gain on positive half-cycles with the average for negative half-cycles; that's what we did earlier. If these gains are the same, distortion will be negligible. If they differ (positive peak gain will be higher), distortion will appear.

To determine how much distortion to expect, subtract the lower gain from the higher one and record the difference. Then add the two gains together, and divide the difference you just noted down by their sum. Multiply the quotient thus obtained by 25, and the result will be the approximate amount of 2nd-harmonic distortion, in percent, which will be produced.

Naturally, harmonic distortion includes more than just 2nd harmonic. However, 2nd-harmonic distortion appears first and becomes objectionable long before the other components are large enough to calculate by this process, so if it's a reasonably small amount, the other components can be ignored.

So far, we've talked only about audio amplifiers. The same principles apply to RF and IF amplifiers in receivers, except that two load lines must usually be plotted for these.

The reason for two load lines instead of one is that the stages of such amplifiers are usually coupled by transformers or chokes, instead of by resistors; this means that the DC supply to the plate sees little resistance, while the AC component of the plate current (which is the desired output signal) sees quite a large "resistance" which forces it to go to the next stage.

To plot these dual load lines, draw a *vertical* line at the supply voltage for the DC load line; this shows that the tube's current is controlled only by the grid voltage. For the AC load line, a bit of figuring is necessary.

First, calculate the amount of current increase which would be produced by a 100-volt increase of voltage through the "resistance" (AC value) of the coil concerned. If the resistance is, say, 100,000 ohms, the current change would be 100 volts divided by 100,000 ohms or 1 ma.

Now, put your pencil at the point where the DC load line crosses the selected grid-bias value. This is the operating point. Measure off 100 volts *toward zero* (an increase in voltage across the load resistance is a *decrease* in voltage to the tube) from this point, and then measure up 1 milliampere (the calculated value) from the current at the operating point. Draw a line from this point you just located, through the operating point, and extending to zero plate voltage and to twice the DC supply voltage. This line is the AC load line; gain can then be found from it by employing the following variation of the procedure already described:

As in the single-load-line procedure, assume an input signal of the largest value you intend to handle. Follow the grid-bias curve corresponding to the resting bias plus the positive-peak value of input signal until it intersects the AC load line. Drop down to the plate voltage scale to determine plate voltage at this point.

Now, follow the grid-bias curve corresponding to the resting bias plus the negative-peak value of input signal until this curve also intersects the AC load line. This intersection point will be to the right of the DC load line; drop down to the plate voltage scale to determine the plate voltage for this point.

Don't let the fact that the negative-peak-signal plate voltage value is *larger* than the voltage supplied to the stage scare you; this

Leo I. Meyerson
WØGFQ

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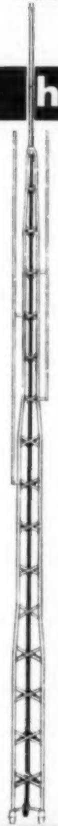

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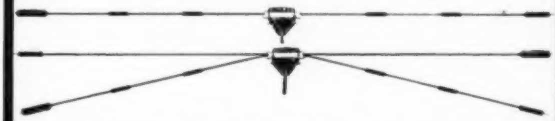

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is natural, since the coil in the plate circuit stores up energy while current flows, so that a signal which reduces current flow releases the stored energy. This stored energy then appears at the plate of the tube as excess voltage, above the plate-supply value.

Once you have found the positive-peak and negative-peak plate voltage values, you can calculate the gain by dividing the swing by the peak-to-peak value of the input signal, just as for the resistive amplifer discussed before.

Not yet mentioned has been the problem of designing Class C amplifiers for transmitters; they are put together in a completely different manner. However, space has run out for this month, so we'll have to postpone that until a later technical article. Until then, keep in mind the three simple resistors—they're the heart of every circuit-design problem!

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Transistorized Modulator

Burt Yellin K2STV

Being like many other hams, I have often sought an efficient, compact, universal modulator. Although only 75% modulation is obtainable through the use of this circuit, it is efficient in that it requires a minute amount of power. Battery current is in the order of microamps, therefore allowing the battery to last its entire shelf life.

The modulator shown in Fig. 1 is capable of cathode modulating any transmitter up to the full power input of one kilowatt. In many instances the transmitter will not have to be modified. If the transmitter uses cathode keying, all you do is simply plug the modulator in, instead of the key.

The circuit uses four NPN transitors compound connected. Compound connected transistors have the following characteristics: a high input impedance, and an extremely high current gain. This is perfect for cathode modulation, as a crystal mike can be used, and the circuit will control the cathode current of the power amplifier in the transmitter. The circuit has one other advantage, and that is that it will act as a clamp tube. Should the final lose drive, the modulator will limit the amount of cathode current, which is determined by the setting of R_1.

Any NPN transistors can be used for Q_1, Q_2, and Q_3 providing their beta is 30 or greater. Q_4 must be chosen by the amount of cathode current that will be flowing through it.

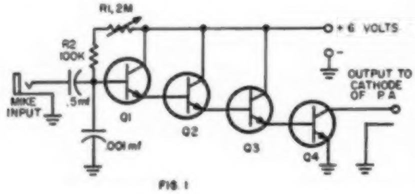

FIG. 1

To use the circuit, tune your transmitter as is normally done for CW operation, insert the modulator, and adjust R_1 until you get the maximum change in cathode current with speech input.

. . . K2STV

TAPE TIP

An ever increasing number of "do-it-yourself" decorative and finish materials are reaching the market. One item that should be attractive to the amateur constructor is an adhesive backed, metal tape that is available in several patterns.

This tape and one application are shown in the photograph. While the tape may be used for strictly decorative purposes, it is convenient for covering equipment finish imperfections and unused holes. Application is a snap. Simply cut the strip to size with a pair of shears, peel off the adhesive protector paper and apply to any clean, dry surface.

The particular product shown in the photograph is a metalized, Mylar tape, sold under the Trimbrite label. The manufacturer is Marglo, Inc., New Britain, Conn. and the tape is available in most hardware stores.

. . . W4WKM

Photograph by: Morgan S. Gassman, Jr.

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- **We Tested**
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- **We Starved**
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We Had—

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- **Parasites**
- **Low Drive**
- **Hi Drive**
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- **Low Modulation**
- **No Modulation**
- **Headaches**
- **Dyspepsia**
- **Fights with the XYL**
- **Low Bank Balance**
- **No Bank Balance**
- **And VFO Drift**

Somehow, some way we solved all these, except the VFO drift, but read on . . .

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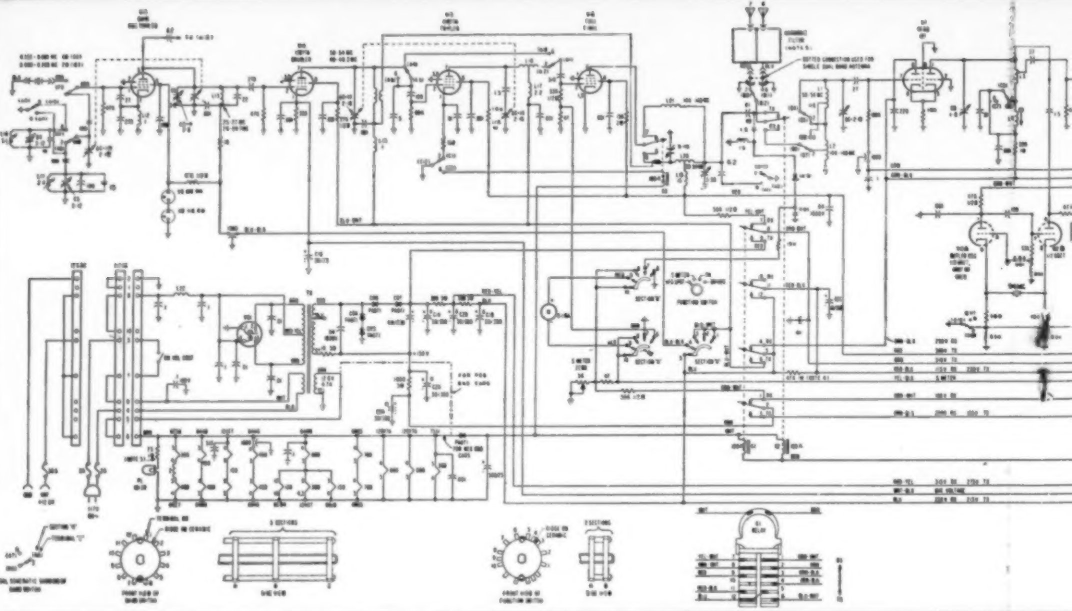


And In Spite of IT ALL;

Receiver: (triple conversion superheterodyne)

Frequency Range: 49.750 to 54.250 MC and 143.750 — 148.250 MC. (Includes C. A. P. Frequency.)

Calibration: 100KC graduations every 4°.

Tuning Ratio: 6:1.

Sensitivity: Better than .2 uv on 6 meters and better than .8 uv on 2 meters for 6 db s + n @ 30% @ 1000 cps modulation.

Selectivity: —6 db bandwidth 8 KC ± 2 KC.
—60 db bandwidth 25 KC ± 5 KC.

AGC: Audio output varies less than 3 db from 1 uv to .1 volt.

Delayed AGC: Knee of AGC occurs between 3 and 10 uv.

Squelch (adjustable): At threshold receiver will awaken for carriers of .08 uv or greater on 6M and will awaken for carriers of .1 uv or greater on 2M. At stop receiver will awaken for carriers of 10 uv or greater. (Stop limit adjustable from 3 to 30 uv).

Noise Limiter: Floating series gate type operates on all noise peaks. Audio unaffected by modulation levels less than 85%.

Audio Output: At least 2.0 watts into 2½" PM internal speaker or at least 3.0 watts into external 4 ohm speaker. Provisions for 5W into external speaker.

Distortion: Less than 15% from 250 to 3000 cps at 1 watt output.

Hum and Noise: Better than 40 db down from 1 watt output.

Freq. Response: Within + 1 db to — 5 db from 250 to 3000 cps (reference 0 db at 1000 cps at 30% at 100 uv).

1st Image: Better than 85 db down on 2M. Better than 40 db down on 6M.

2nd Image: Better than 60 db down.

3rd Image: Better than 85 db down.

Spurious Responses: Better than 50 db down everywhere except within ± 20 KC of desired signal.

Internal Generated Spurious Signals

145.17 approx. 90 uv (S9)   147.80 appro

Cross Mod and Desensitization: Better than 50
± 20KC.

IF Frequencies: 52.00 MC (± 2 MC)
5.405 MC   455 KC

Compliance: Meets FCC Rules Part 15 re
Radiation Device.

Stability: Less than ± 15KC During 40 minu
Less than ± 2KC/HR thereafter.

Transmitter (separate osc, multiplier, (S)
through final amplifier)

Plate power input to final: 18w 6M 17w 2M.

RF Power Output: At least 9.0 watts output o
At least 4.0 watts output o

Mod. Cap.: 85 to 100% at average speaking le
modulation.

Hum and noise on carrier: at least 40 db dow
modulation level.

Harmonic Suppression: All harmonics and sp
sions better than 50 db down. Exceeds lat
quirements.

Microphone (all press-to-talk): unit normally s
grey plastic high impedance detachable ce
phone with 5' retractable coil cord. Includ
hardware.

Frequency Control: VFO or crystal.

Crystal Stability: ± .005% —30° C. to + 7

Crystal Circuit Stability: ± .006% — 20°C.

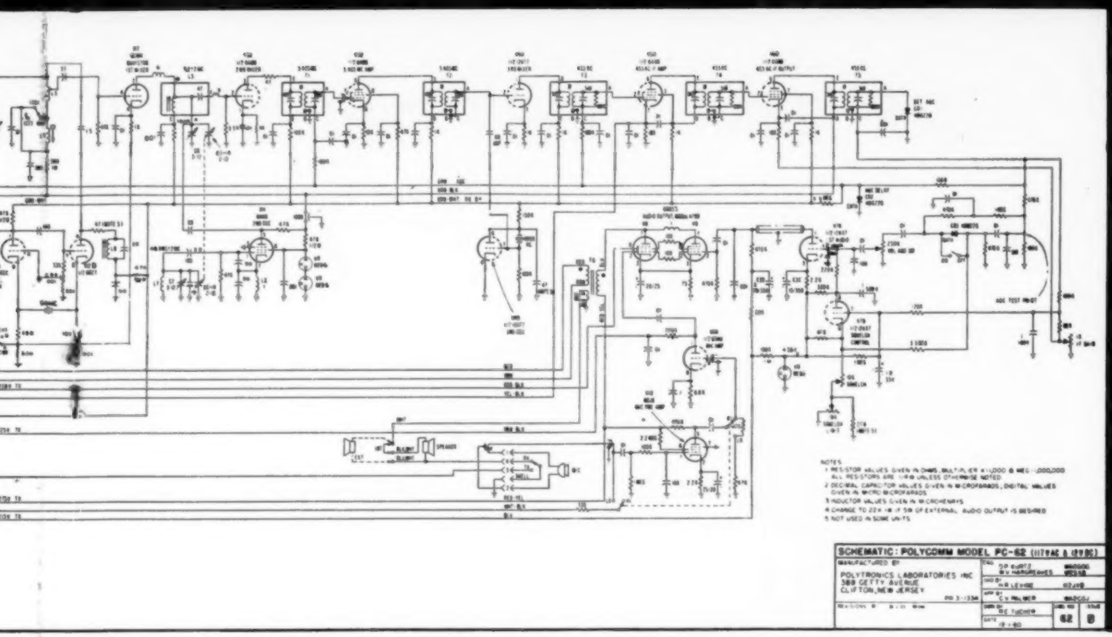
VFO Stability: Less than ± 25KC on either
40 minute warm up. Less than ± 6KC/HR

Humidity: Will perform after being subjected
95% relative humidity for 8 hours.

Vibration: Will withstand 10G shake from 60
for 30 minutes in three planes.

Shock: Will withstand 15G shock in three plane

Supply Voltage Variation: — 20 to + 10% of
voltage.


NOTES
1 RESISTOR VALUES GIVEN IN OHMS, MULTIPLIER K=1,000 & MEG=1,000,000
ALL RESISTORS ARE 1/2W UNLESS OTHERWISE NOTED
2 DECIMAL CAPACITOR VALUES GIVEN IN MICROFARADS, DIGITAL VALUES GIVEN IN MICRO MICROFARADS
3 INDUCTOR VALUES GIVEN IN MICROHENRYS
4 CHANGE TO 22K ½W IF 5W OF EXTERNAL AUDIO OUTPUT IS DESIRED
5 NOT USED IN SOME UNITS
SCHEMATIC: POLYCOMM MODEL PC-62 (117VAC & 12VDC)
MANUFACTURED BY
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62
B

47.80 approx. 80 uv (S8)
tter than 50 db down at

C)
KC

Part 15 re: Incidental

ng 40 minute warm up.
r.
iplier, (S) and straight

17w 2M.
ts output on 6M
ts output on 2M
speaking level via plate

40 db down from 30%

nics and spurious emis-
Exceeds latest FCC re-

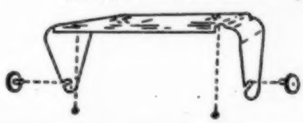
normally supplied with
achable ceramic micro-
ord. Includes mounting

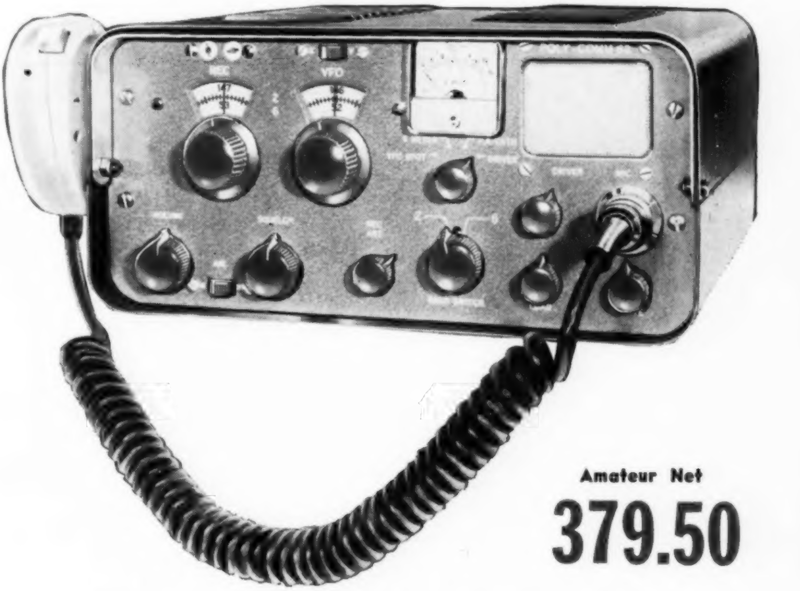
C. to + 70°C.
− 20°C. to + 60°C.
on either band during
± 6KC/HR thereafter.
subjected to 90°C. at
.
e from 60 to 1800 cps.

three planes.
+ 10% of rated input

AC Power Consumption: 90 watts receive, 140 trans.
DC Current: 10 Amps rec. 16 Amps trans. @ 12.6 volts.
Size: 11" wide x 10" deep x 5" high.
Weight: 15 lbs. total system weight.
Color: Marine grey, maroon knobs, white lettering, brushed aluminum grill.
Shipping Weight: 23 lbs.

The PC 62B is a COMPLETE 2 band mobile/base station ready to operate. Well almost, need an Antenna? Turn →

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VFO
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DRIVER
MIC

Amateur Net

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Polytronics is very proud of the fact that all its technicians are very active Hams well acquainted with the performance desired and required by VHF enthusiasts. The PC-62 was designed by WA2GOG and W2SXB. The President of Polytronics is K2JXB. All power supplies are checked out by Hal, K2SGX, the Tx section specialist is Steve Fancher, WA2ZNE. Shade M. Lee, WA2OJB aligns the receivers, while Pearl (Tiger) Maguire, WA2QNY, tracks the VFO. After all this, Joe, K2QLW, (Quality Control) gets a chance to reject any unit not up to his high standards.

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●

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AGC for the Swan Transceiver

Lawrence Frazier K6SHC

THE Swan 100 series transceivers have caught the eye of many hams, both for mobile and fixed use. These transceivers are sensitive and have a good punching signal on the air.

In talking with many of the fellows who have these transceivers, the one slight improvement desired was an AGC system. When in a round-table with several stations, some are bound to be much louder than others. This requires one hand on the gain control, or a good set of nerves.

The AGC board will be very easy to construct and can be built from parts in the average junk box. The audio choke CH1 can be made from the high impedance (plate) winding of a small audio output transformer. The diode should have a peak inverse rating of at least 300 volts. The current rating need be only a few milliamps, as the current is very low. Good back resistance is very important to keep the positive level set voltage from loading the circuit.

In working with the mounting problem, it was decided to mount the AGC parts all on one board and then mount the board on the side of the metal cover which covers the 5.5 mc crystal filter. Care should be taken in placing the screw holes so that the screws will not touch the crystals or the coil in the center. The wires which go below the chassis can be put through the rubber grommet through which the wires to the relay already go. Small wire should be used so that they will all fit through the grommet easily.

Connection of the AGC to the transceiver should be done as follows: With the AGC wired, tested, and mounted, there should be five wires (including the ground wire) which should go through the grommet to the underside of the chassis. Connect the wire from terminal (1) to the plate of the audio output tube (6AQ5 pin 5). Connect the wire from terminal (2) to the plus 150 volts on the OA2 pin (1, 5). Locate the 1 meg resistor connected to pin (1) of the 1st RF amplifier (6BA6). Remove the end of this resistor which goes to the terminal lug with the rf choke also connected to it. Connect the wire from terminal (4) to the loose end of the resistor just removed. Insulated sleeving should be used to protect against shorts. Connect the wire from terminal (5) to the terminal lug from which the 1 meg resistor was removed. The last wire, from terminal (3) should be connected to a convenient ground terminal on one of the tube sockets.

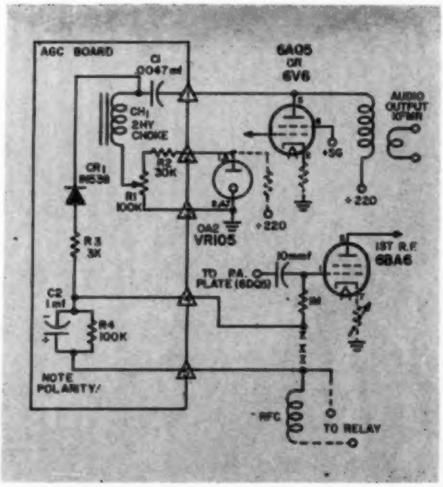
The only control is the level set potentiometer R1 which is used to set the relative level of the clamping action. After this level set has been adjusted for the particular rig, it will not require any further adjustment. Therefore, it can be placed inside the rig out of sight. After the AGC has been installed and checked out, it may be desirable to change the recovery delay time slightly. In order to make the receiver recover faster after a loud signal goes off, the value of R4 should be decreased, but by no more than 40K. To make the receiver recover slower, thereby making quieter operation, the value of R4 should be increased. The value of 100K seems to hit a happy medium.

This AGC is in use in several units and functions quite well. There is little or no attenuation of the weak signals, and the loud signals are clamped to a comfortable level. The gain control on the front panel still functions to control the gain and relative audio output level. Some checks were made, using a sharp cut-off tube (6AK5) in the input stage, and it seemed to produce a more pronounced clamping action.

This circuit has been tried in other receivers with very good results. The best clamping action seems to be with a high gain, sharp cut-off tube in the front end.

With this AGC in your Swan, there will be no more need to keep one hand on the volume control when in a round-table, or while signals fade in and out while driving down the road.

. . . K6SHC



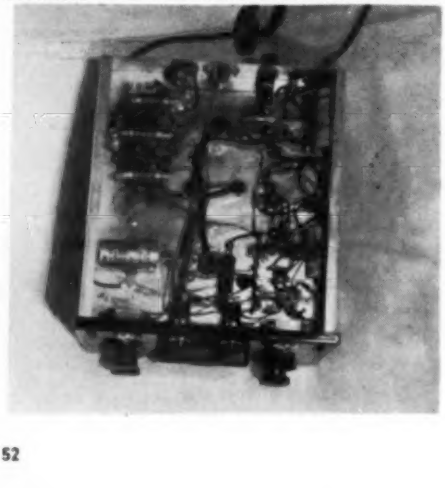
Note: The audio output tube may be a 6V6, in which case the proper pin changes should be made. Also in later models, the type relay has been changed so that there is no grommet by the relay. In this case, the wires to the under side will have to go through one of the other grommets.

160 Meter Mickey Mouse

C. L. Martin K9PAL
Instrument & Electronic Tech.
General Electric Company
Bloomington, Illinois

WITH the increased amount of activity on the amateur bands these days, it becomes even more difficult to find the frequency space to carry on the famous "rag chew" session with the local brothers of the profession without "tromping" on some poor soul in the next state who is trying to stretch some range out of the "Half Quart" rig, or move that piece of traffic thru the QRM. Faced with these problems, it becomes even more sensible to make use of that 25 kilocycle hunk of frequency in the 160 meter band for the "local" activity. Range of 25 miles or so is consistent on these frequencies with occasional real DX reported on quite low power. So, to this I add the question "Why not a rig that is portable enough to carry to the over night fishing hole or on the vacation"? The rig described here, combined with a "tuned over" AC/DC set or, small portable provides this portability as well as reasonable power on a vertical or half of the old 75 meter dipole.

Circuit and construction is along conventional lines with the exception of the power supply, which is less common. Here the circuit makes use of a pair of the modern silicon rectifiers in a half wave doubler circuit running straight out of the 115 volt line. Two things are accomplished by this. First the familiar power transformer is absent (a sizeable cost reduction) and second, the ac ground system is used to advantage with the portable whip. To do this without making the cabinet "hot," a built in line polarity indicator is used. With the power switch OFF and the chassis connected to the line "hot" side, the neon will provide enough glow thru leakage to be seen, even if no ground is present on the cabinet. If the neon glows, the line plug need only be turned ½ turn to correctly polarize. A 2 amp fuse in the ground side provides protection in case of a mistake in polarity when the rig is attached to an earth ground. Such a system is not dangerous when handled properly. It is strongly advised that an earth ground be attached to the cabinet whenever possible, however.



Parts placement is not critical and no shielding between components should be necessary. It is suggested that the modulator be placed as far as possible on the chassis from the rf section. The familiar 6L6 was selected for the final stage because it operates efficiently at the relatively low plate voltage and is usually readily available from the junk box. Grid drive should be adequate when the OSC tuning coil is peaked. If more drive is required, this can be accomplished by decreasing the 20K dropping resistor in the oscillator plate. Grid drive should be near 3 ma.

Although the final is capable of more than the 18 watts indicated, the modulator is good for only about 9 watts. If 100% modulation is to be realized the final must be held down to this value.

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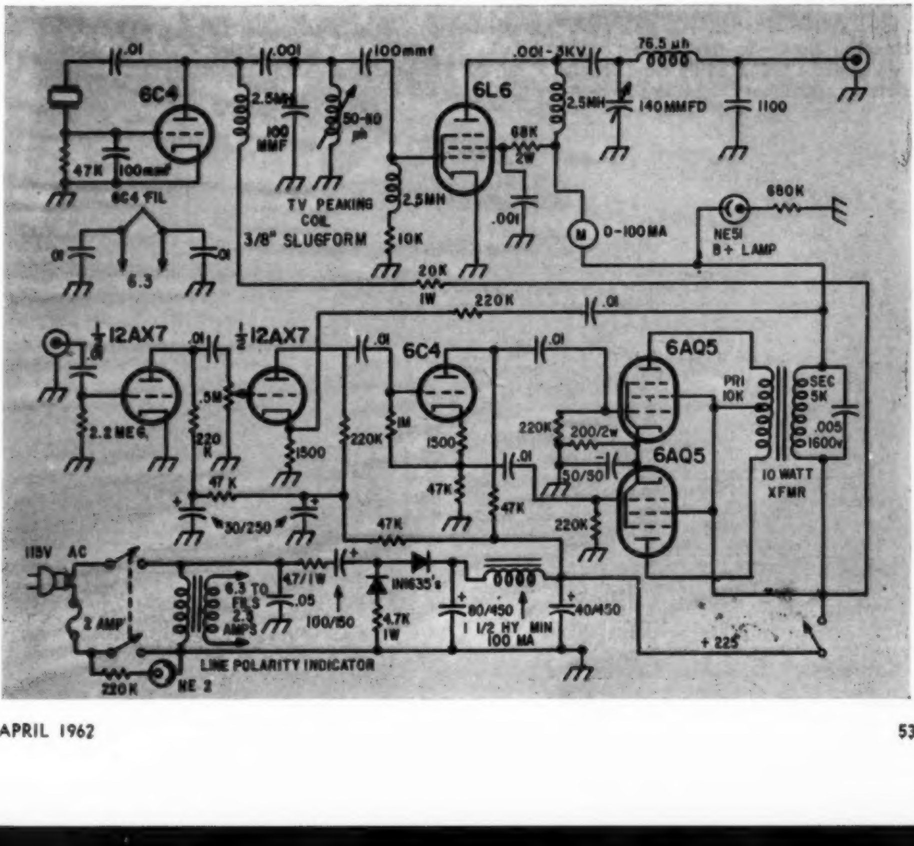
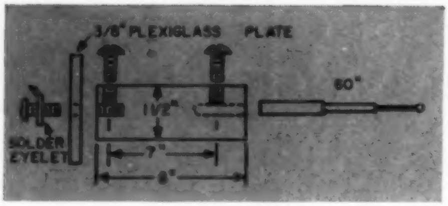
Cabinet construction is three piece with the 1½" chassis fixed to the front plate by the switches and indicating lamps. The cabinet is wrap around constructed with a partial back panel installed. Two ⅞" chassis punch holes are made in the cabinet, one to allow mounting of the whip and the other to allow the banana jack antenna terminal clearance. This jack is sub-mounted on a piece of ⅛" Plexiglass for insulation. Cabinet dimensions are 6" H x 9" W x 10" deep.

The whip is a 60" automotive replacement antenna. The base loading coil is constructed of Textolite or similar dowel, 1½" dia. 8" long. A 2½" x 2½" square of ⅜" Plexiglass forms the base. This is mounted to the dowel with a single #8-32 screw which is first placed over a solder eyelet. Connection for the winding is obtained by drilling and tapping for a #4-40 of length to jam the #8-32 mounting bolt. An appropriate size hole into the top of the dowel will mount the whip. Again the winding solders to a #4-40 jam bolt (see sketch). The coil is close wound of #22 enamel over 7" of the diameter of the coil. Total turns should be approximately 260. Actual loading of the coil can be accomplished by on the air tests. A simple way to achieve this is to extend the whip fully and tune the final to resonance with the loading capacitor fully closed. The plate switch may be turned off and on, the final "dipped" and the extension whip


.01
6C4
47K
100mmf
6C4 FIL
.01
6.3
.01
.001
2.5MH
100 MMF
50-110 µh
TV PEAKING COIL 3/8" SLUGFORM
100mmf
2.5MH
10K
20K 1W
6L6
.001-3KV
2.5MH
68K 2W
.001
76.5 µh
140MMFD
1100
0-100MA
NE51 B+ LAMP
680K
220K
.01
½ 12AX7
.01
2.2 MEG.
.01
½ 12AX7
.5M
220 K
1500
47 K
30/250
.01
6C4
220K
1M
1500
47K
47K
47K
.01
6AQ5
220K
200/2w
.01
50/50
6AQ5
220K
PRI 10K
SEC 5K
.005 1600v
10 WATT XFMR
115V AC
2 AMP
6.3 TO FILS 2.3 AMPS
47/1W
.05
100/150
1N1635's
4.7K 1W
80/450
1 1/2 HY MIN 100 MA
40/450
+ 225
LINE POLARITY INDICATOR
220K
NE 2


3/8" PLEXIGLASS PLATE
1 1/2"
60"
SOLDER EYELET
7"
8"

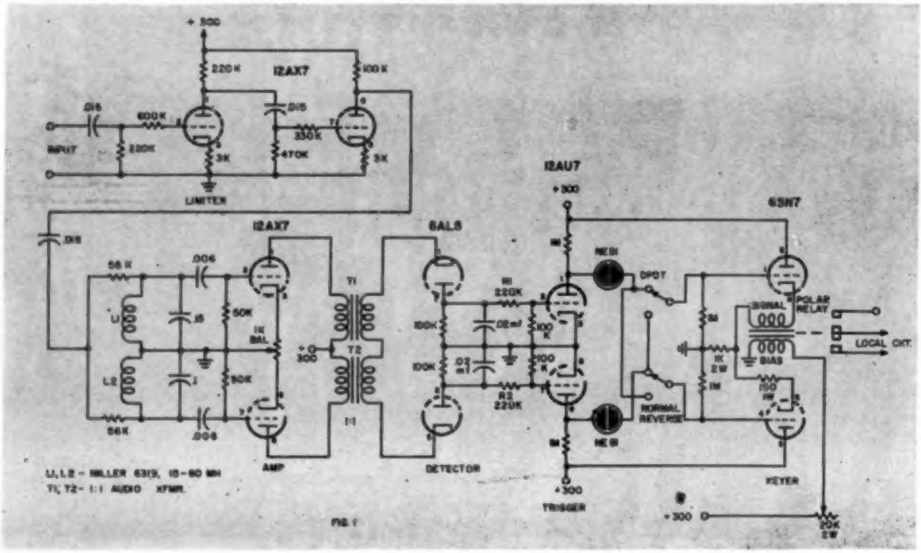
slid down to the point where maximum plate current is drawn while in resonance. This is the tuned point for the antenna. To load it will probably be necessary to extend the antenna ½ inch or so from the tuned point. It is then only necessary to remove a few turns from the whip and extend it again to the tuned point. Remove enough turns to tune the whip about 4 inches from fully extended. This will then allow for variables in loading in different locations where the antenna system is influenced by metal, etc.

Three of these units have been constructed by your author and they have proven to be extremely versatile rigs to own. Audio quality is excellent, signal output is very good (20 miles on the whip) and no component has failed on any unit after having been in service for several months. . . . **K9PAL**

Improve Weak Signal Radio-Teletype Reception

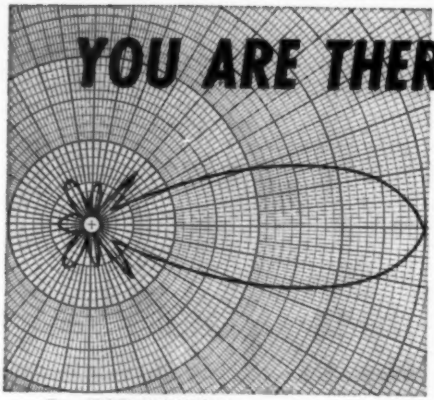
Woody Davey W7CJB
329 East Kent
Missoula, Montana

THE circuit in Fig. 1 is somewhat conventional, but with balanced detector, trigger and keyer tubes. A filter circuit consisting of an .02 mfd condenser, two 100K resistors and the 220K resistor form a long time constant circuit in the detector output which completely wipes out noise spikes that could trigger the keyer stage when signals are weak. Observations on the scope indicate all traces of noise spikes are eliminated by this circuit. It can be shown that removal of these condensers during noisy reception will cause very bad garbling of otherwise perfect copy. Note coupling resistors R1 and R2 on the grid of the driver tube. Both resistors are identical, their value being determined by the voltage developed at the plates of the 6AL5 detector. These are nothing more than part of a voltage divider to drop the dc voltage on the grids of the 12AU7 to —8 volts as measured on a VTVM, when the respective half of the 6AL5 is conducting. Transformers T1 and T2 are approximately 1:1 but if substitutions are made it will only be necessary to adjust the coupling resistors R1


+300
220K
12AX7
100K
.015
600K
.015
330K
INPUT
220K
3K
470K
3K
LIMITER
.015
12AX7
6AL5
56K
.006
L1
.15
50K
1K BAL
L2
.1
50K
56K
.006
T1
+300
T2
1:1
AMP
100K
100K
.02 mf
.02 mf
R1 220K
R2 220K
100 K
100 K
DETECTOR
12AU7
+300
1M
NE51
NE51
1M
+300
TRIGGER
6SN7
DPDT
NORMAL REVERSE
1M
1K 2W
1M
SIGNAL
POLAR RELAY
BIAS
LOCAL CKT.
150 1W
KEYER
+300
20K 2W

L1, L2 - MILLER 6319, 15-60 MH
T1, T2 - 1:1 AUDIO XFMR.

FIG. 1



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ASBURY PARK 40, NEW JERSEY, U.S.A.

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and R2 so that —8 volts appears on the 12AU7 grids when the limiter is saturated and with the proper tone at the converter input. The K1 balance control in the cathode of the 12AX7 amplifier is adjusted to equalize the voltages on the 12AU7 grids when the respective mark or space frequencies are selected. Minus 8 volts on the 12AU7 grid will cause an increase in the plate voltage to at least 60 volts which will fire the neon properly.

The 6SN7 keyer tube could operate balanced with one winding of a type 255A polar relay in each cathode, but I prefer to replace one winding with a 150 ohm resistor and to provide bias current to the disconnected winding. In this case the actual keying is done on space signals, but you have a built-in "mark." The polar relay bias current should be adjusted to exactly ½ the current value of the "signal" winding when that portion of the 6SN7 is conducting. In this case 30 ma in the signal winding necessitated a bias current of 15 ma.

The DPDT switch on the NE-51's allow copy of "normal" or "reversed" signals. Prior to the development of this circuit I had tried several discriminator type detectors followed by various trigger and keyer circuits, but with signals down in the noise, the above converter would outcopy the disciminator type of converter. Comparison was direct, with the two converters side by side.

The TV width coils can be replaced with 88 mh toroids by tuning them to the proper frequencies. The toroids give somewhat better selectivity, and due to the higher "Q" there is an incease in the detector output voltage of approximately 8 or 9 times (who said TV coils were high Q?). With toroids it will be necessary to increase the value of R1 and R2 to 1.5 megohms.

As a matter of interest selectivity curves were run on both the toroids and the TV width coils. The width of the selectivity curve at the ½ voltage point (6db down), is as follows:

	2125 center freq	2975 center freq
TV width coil	570 cps	890 cps
88mh Toroid	180 cps	330 cps

It can be easily seen that toroids would be a definite improvement when the QRM is bad.

Another real problem in radio-teletype reception is selective fading. One does not notice this unless the audio is either metered or observed on a scope. This can be quite severe at times and I have observed as much as 20 db difference in the two tones, fist one and then the other being the stronger. I might suggest the use of separate audio limiters in each channel to help overcome this. Tuned circuits should be used ahead of the limiters to separate the two tones, prior to limiting. ... W7GJB

Positive Transistor Protection

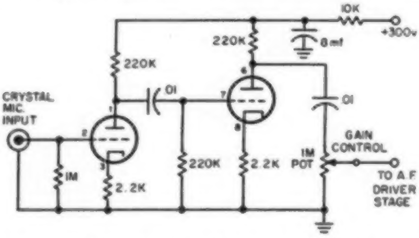
In most transistorized equipment, if the polarity of the power supply is connected backwards, the result is a mass of melted germanium, damaged electrolytics, and an abundance of profanity. With the nine volt or penlight batteries it is quite easy to connect them backwards, especially if you are anxious to try the equipment out or go somewhere. To prevent this, it is only necessary to put a small diode in series with the battery. If the polarity is connected incorrectly, no current will flow so no damage will result. For small, low power equipment, a general purpose diode will work. Where the current is higher than 20 ma. or the voltage higher than 6 volts, a small, low piv silicon diode should be used. ... WA2INM

Pre-Amp Curve Shaping

Charles E. Landahl W5SOT
121 Barranca Road
Los Alamos, New Mexico

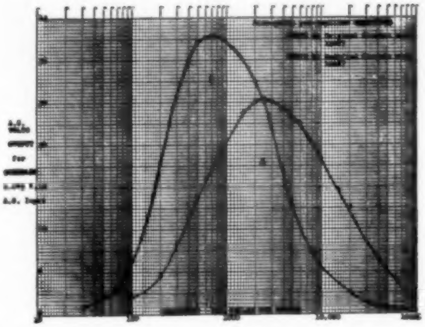
THE following microphone pre-amplifier is presented as a helpful suggestion, and, is a small commentary upon the simplicity of resistor—capacitor filtering. A glance at the experimentally derived curves shows the narrowing of the audio pass band of a common type of microphone pre-amp, when the tube and associated circuit values are changed. The original circuit is found in many amateur applications and borders upon high fidelity practices. It is possible to find transformers for the following stages which will sharpen the bandwidth of the modulator system, however, such transformers are costly to make and are seldom found in moderately priced equipment.

It was fun to experimentally determine an optimum compromise between microphone, tubes, coupling capacitors and plate resistors, which would help narrow the audio pass band of the pre-amplifier shown in the schematics.



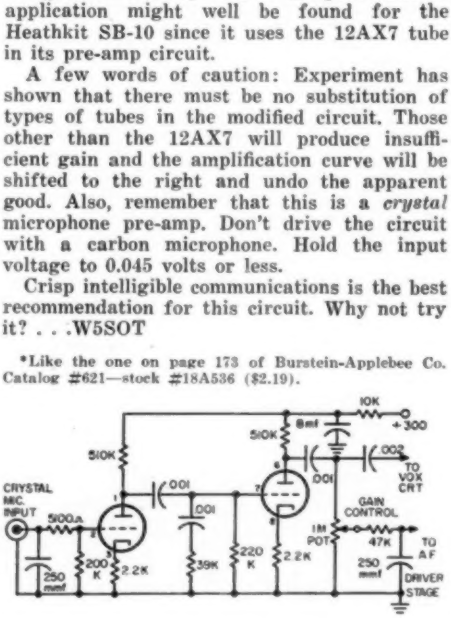
Don't be frightened by the low value of input grid resistor, nor the high values of the plate resistors. Remember? We want to restrict the audio range and occupy fewer of the precious kilocycles available to us. The low value of input grid resistor helps to get rid of the low frequency response of a high impedance crystal microphone. The high value of plate resistors tend to keep the voltage gain up and assist with the attenuation of frequencies either side of 750 cycles per second. The .001 mfd coupling capacitors contribute to low frequency roll off, while the .001 mfd plus the 39K series resistor shunting the grid of the second stage puts the finishing touch to the higher frequency roll off. The results obtained with the completed change is demonstrated in the curves and makes you feel as though you have done something to help your transmitter put out a more conservative frequency spectrum.

A detailed inspection of the curves show "A" as the amplification characteristic of the original circuit. Curve "B" is the characteristic developed by the changed circuit. In both cases the input voltage to the microphone jack was held at 0.045 volts ac, rms, as measured by a vacuum tube volt meter. Output was taken at the junction of the 47K resistor and the 250 mfd capacitor shown to the right of the gain control by means of VTVM. Note that the band width at the half voltage points is approximately 19.5 kc for the original circuit. It becomes approximately 3.8 kc for the modified circuit at the same point. Further comparison at the 3 dbv down points show 10 kcs for the original versus 2.3 kc for the modified. This is a modest but valuable improvement. It is especially valuable for those of us with low resonant voices. A high impedance crystal microphone, rated at -54 dbv* will produce full undistorted output from a Central Electronics Model 10-B exciter, with the gain control adjusted to ¾ open. Another application might well be found for the Heathkit SB-10 since it uses the 12AX7 tube in its pre-amp circuit.



A few words of caution: Experiment has shown that there must be no substitution of types of tubes in the modified circuit. Those other than the 12AX7 will produce insufficient gain and the amplification curve will be shifted to the right and undo the apparent good. Also, remember that this is a *crystal* microphone pre-amp. Don't drive the circuit with a carbon microphone. Hold the input voltage to 0.045 volts or less.

Crisp intelligible communications is the best recommendation for this circuit. Why not try it? . . .W5SOT



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*Like the one on page 173 of Burstein-Applebee Co. Catalog #621—stock #18A536 ($2.19).

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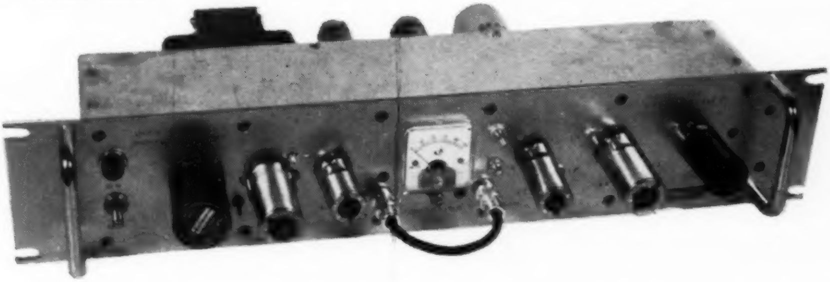

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99 ELM STREET • WEST NEWTON 65 • MASSACHUSETTS

Dick Gridley K6JHJ
Edison Powerhouse #8
Auberry, California

Photography by Linda Gridley

The BC453, One More Use

THE slicer to be described here came into being because of crowded band conditions and an unyielding XYL. The simple solution, of course, is the purchase of a new receiver—but this approach brought only lumps, and I knew I couldn't talk 75% of the hams in California to leave the air.

The need was for a sharper receiver for CW and a good method of detecting Single Sideband. Both of these requirements were filled, plus a fine method of detecting AM was gained.

The heart of the slicer is the 85 kc filter which is constructed from the *if* transformers of the BC453. The filter is not flat on top, but it has a good shape factor. The 3 kc points are 5 DB down and at 6 kc the attenuation is 35 DB. This is a pretty fair filter for the price. I had a BC453 in the junk box—if you don't, there are ads in 73 selling them for $9.95 and this is a lot less than any filter on the market.

The product detector is the one described by ZL1AAX in the August '59 CQ magazine.

The mixer is the "like-new" mixer described by the staff in the October issue of 73. The choice of the 6J6 was made because the original slicer used a 6BE6 mixer and I didn't want to change the socket.

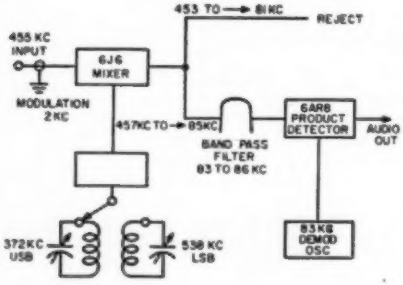


FIG. 1

The operation is simple, and if you follow the block diagram Fig. 1, it is easy to see. Starting with the incoming signal of 455 kc into the 6J6 mixer, it is mixed with the selected oscillator frequency of either 372 kc USB or 538 kc LSB. The fundamentals tell us that in this conversion there will be four frequencies—the incoming frequency, the oscillator frequency, and their sum and difference. In this slicer we are only concerned with the difference.

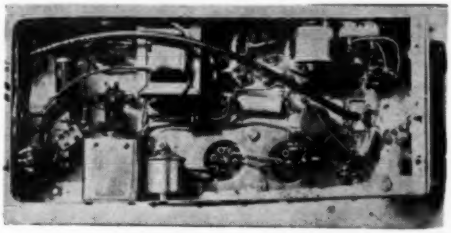
A little math at this time will show that 455 kc less 372 kc is 83 kc, and 538 kc less 455 kc is 83 kc. The differences are the same. However you will note that we position the oscillator either 83 kc above, or below the carrier frequency of 455 kc. We will now add a 2 kc modulating frequency to the carrier. Going once more to fundamentals, we know that we now have the 455 kc carrier with a 457 kc USB and a 453 kc LSB.

For simplicity of explanation, let us leave the 455 kc carrier at this point and consider only the sidebands as they enter and leave the mixer. If the selector switch is placed on the USB position the oscillator will inject into the mixer a frequency of 372 kc. The upper sideband of 457 kc will convert to and leave the mixer at 85 kc and the lower sideband of 453 kc will convert and leave at 81 kc. If the selector switch is set on the LSB position, the oscillator will inject into the mixer a frequency of 538 kc, and now the upper sideband of 457 kc converts and leaves the mixer at 81 kc and the lower sideband of 453 kc converts and leaves the mixer at 85 kc. Simple, what?

Looking now at Fig. 2, the band pass filter, you will note that the 85 kc point is in the middle of the filter and the 81 kc point is placed down the skirt of the filter to a point that gives a rejection of 40 DB. Thus, with the selection of the sideband switch, we can select or reject the sideband we want.

The selected sideband is then fed to the product detector and is beat against the low frequency demod oscillator. The output to the audio stage is the difference (85 kc less 83 kc) 2 kc. It will be noted, I hope, that this explanation is for the purpose of understanding the slicer operation, and in practice is just the reverse of the alignment.

The use of the sheetbeam tube as a product detector has been covered in many good articles and will not be repeated here.



The audio section is also skipped as any pet circuit will work as well as this one. In fact, the choice of tubes and components in my slicer was a matter of what was in the junk box and not a matter of choice. ZL1AAX said in his article that the 6AR8 is as extinct as a Dodo bird, and it might be well to consider the 6BU8 or the 7360.

Construction is straightforward. Extra care should be taken in the construction of the oscillators. They must be stable within 30 cycles. This is easily accomplished by the use of high quality parts and rigid mounting. My unit was constructed on the old BC453 chassis, fitted with a new face and deck made of 3/32 aluminum. The only question that might arise is power. The base station here uses a common power supply and has power to spare. If your receiver does not have enough reserve, it might be well to consider a chassis big enough to make the unit self contained with its own power supply.

Before dismantling the BC453, you should have a schematic. If not, you can mark the BFO coil and the *if* transformers when removing them. The BFO coil was used as is, the *if* transformer covers were removed and wires were soldered to the inside lugs and brought out the bottom. This way I was able to use the base mounting ears to mount them to the new chassis with 4/40 machine screws.

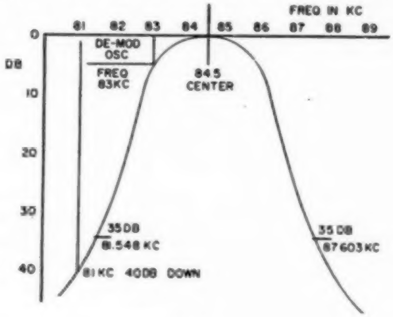
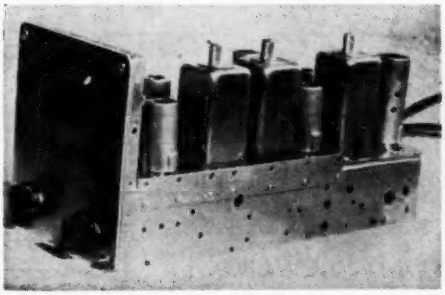


FIG. 2

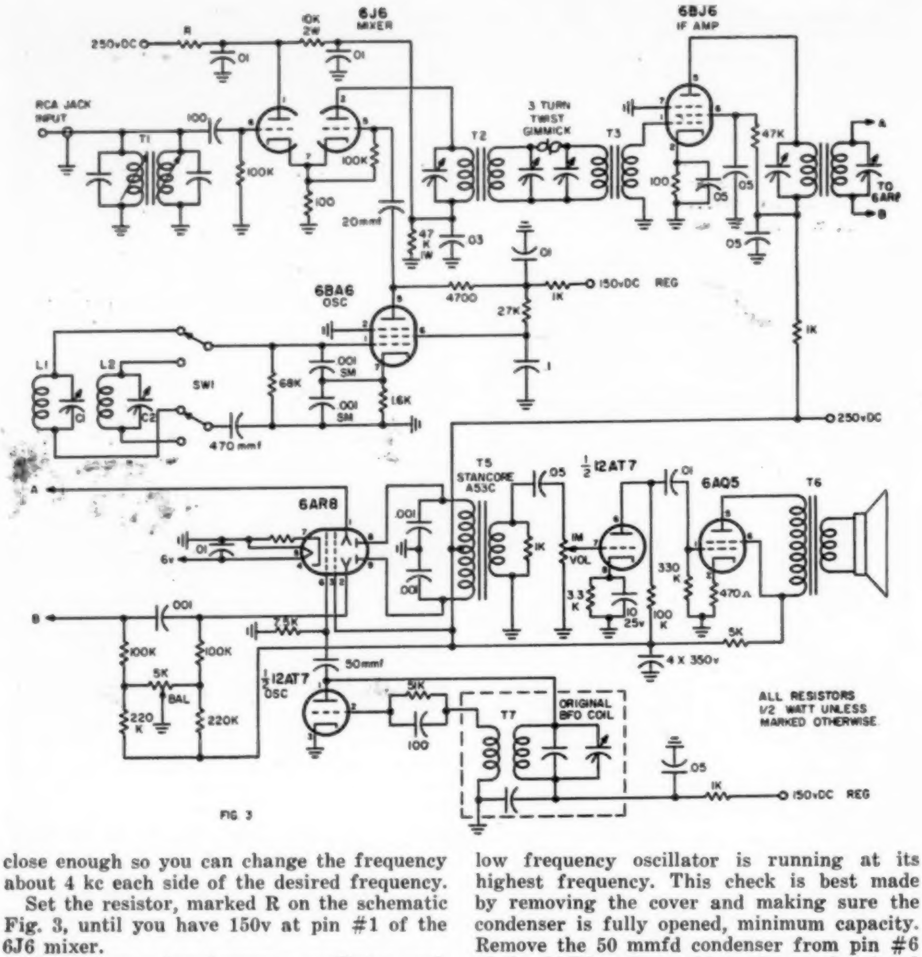
A note of warning here, the 3X.05 capacitors in the BC453 should be checked for leakage. Remember these are at least fifteen years old, and I have found that about 50% of them are bad—this kind of trouble we don't need.

T1 is a Miller K-TRAN 12C1 455 *if* transformer. T2, T3, and T4 are the 85 kc *if* transformers from the BC453. T2 is the input, T4 is the output. The gimmick between T2 and T3 is three turns of the two leads twisted together and doped. T5 is a Stancor A53C, 1 to 3 interstage, plate to grid transformer connected in reverse. T6 is a standard audio output transformer. The one I used was removed from a Philco TV set. T7 is the 85 kc oscillator coil removed from the BC453.



Now comes the tough one. L1 was made from an old 262 kc *if* transformer that was way down in the junk pile. I believe it came from an old car receiver. I removed the shield can and kept the ceramic form and both padders in tact. The two padders are C1 and C2 which are mounted on the chassis with one winding of the 262 kc *if* transformer. L2 was made from a self-supporting 2.5 mh RFC. I removed about 20 feet of wire from the winding of L1. L2 was made by removing 1 pie from the RFC. However, I think the best way to approach these coils is with a BC-221 which is covered in the alignment. I do feel this is the one point of failing in this unit. It would be better to pick up a couple of slug tuned inductors, for you who are lucky enough to live near a radio store, as these *if* trimmers were never made for vernier tuning.

The first step in putting the slicer into operation is the pruning of L1 and L2 to frequency. So let's take L1, this will be the 372 kc oscillator. Compress C1 and C2 about ¾ closed. Fire up the BC221 and check the frequency at pin #5 of the 6J6 mixer. Start removing turns until you are close. I removed about 20 feet of winding from this one I used. Then repeat the process on L2, which is the 538 kc oscillator coil. From this one I removed one full pie from the RFC. You should come



6J6
MIXER
6BJ6
IF AMP
250vDC
R
10K
2W
.01
.01
RCA JACK
INPUT
100
T1
100K
100K
100
20mmf
47
K
1W
.03
T2
3 TURN
TWIST
GIMMICK
T3
100
.05
.05
47K
.05
A
B
TO
6AR8
.01
150vDC REG
4700
1K
6BA6
OSC
27K
1K
L1
L2
C1
C2
SW1
68K
.001
SM
.001
SM
1.6K
.1
470 mmf
250vDC
T5
STANCORE
A53C
.05
½ 12AT7
.01
6AQ5
T6
A
6AR8
.01
6v
.001
.001
1K
1M
VOL
3.3
K
10
25v
330
K
100
K
470Ω
B
.001
2.5K
100K
100K
5K
BAL
220
K
220K
50mmf
½ 12AT7
OSC
51K
100
T7
ORIGINAL
BFO COIL
5K
4 X 350v
.05
1K
150vDC REG

ALL RESISTORS
1/2 WATT UNLESS
MARKED OTHERWISE

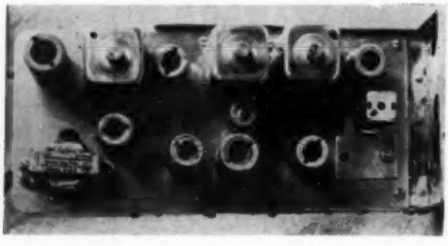
FIG. 3

close enough so you can change the frequency about 4 kc each side of the desired frequency.

Set the resistor, marked R on the schematic Fig. 3, until you have 150v at pin #1 of the 6J6 mixer.

If you have a low frequency oscillator, such as the Hewlett-Packard 200 and a VTVM, the alignment of the filter is standard and should be peaked up at 84.5 kc—then set the slicer's low frequency oscillator at 83 kc.

Another way that works out well is to use the low frequency oscillator of the slicer for the alignment generator. Make sure that the low frequency oscillator is running at its highest frequency. This check is best made by removing the cover and making sure the condenser is fully opened, minimum capacity. Remove the 50 mmfd condenser from pin #6 of the 6AR8 and use this to insert the signal into the filter. Peak the filter for maximum output at pins #1 and #2 of the 6AR8 and then slide the oscillator's frequency down until you have a 5 DB loss. This will put the filter center at about 83 kc, as the low frequency oscillator's highest frequency is about 83 kc. This will not effect anything except the exact frequency of the sideband selector oscillator.



I used a Hewlett-Packard 200 oscillator, 400D VTVM, an Erie counter, a low frequency sweep generator, and a Tektronix 316 scope to set this one the first time. Then thinking you fellows may not have access to the equipment that I do, I detuned this one and worked the alignment mentioned earlier using the slicer's low frequency oscillator as the alignment generator. It proved out very close to the original figures and no difference was noted in the performance.

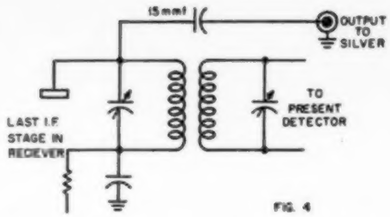


FIG. 4

The next step is to make sure that the injection level is correct at both mixers. With an rf probe on the VTVM, check at pin #6 of the 6AR8, it should be between 2 and 3 volts. The coupling shown gave me 2.7 volts. Next, check pin #5 of the 6J6 mixer for 2 volts. The coupling shown gave me 2.1 volts.

We are now ready to put the slicer into operation. Connect the slicer to the output of the last *if* stage in the receiver through a 15 mmfd condenser, Fig. 4. Tune in a strong AM. signal and peak up on the S. meter. Turn off the AVC and turn the rf gain to about ½ open. Turn the audio up on the slicer and tune C1 or C2 (which ever one is in service) to zero beat. This will give natural sounding audio. Now change the selector switch and repeat for the other trimmer condenser. You should be able to switch from USB to LSB with no noticeable change. Adjust the 5K balance pot in the 6AR8 circuit for minimum intermodulation distortion and that is it.

The only check left is for your own satisfaction and proof that the product detector is doing all that it is supposed to. All the articles tell you that the only thing demodulated in a product detector is that which beats against the oscillator. Therefore, if you kill the low frequency oscillator, the slicer should go dead and if it is working correctly, it will. The measured carrier leak with the oscillator off, in my slicer, is down 45 DB.

This unit will please the most discriminating ham with its performance not only on SSB. detection, but on CW. and AM. phone as well.

I feel the big bonus is the use of it on AM. If you are copying a station and another station comes in close enough to cause heterodyne, all that is needed is a flip of the switch to select the other sideband and exit heterodyne.

The first time I tried it on CW I thought the slicer was dead, but tuning across the band the signals seemed to jump out from dead silence.

It is a real nice addition to any shack, and if all the parts were purchased from scratch I don't know how the cost could go over $20.00.

All that is left to say now is—start digging into the junk box and heat the soldering iron. The enjoyment received from the hetereodyne-free operation of this unit is well worth the time it takes to build it.

. . . K6JHJ

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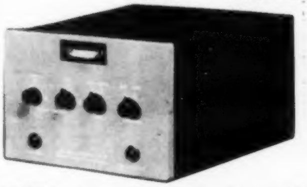

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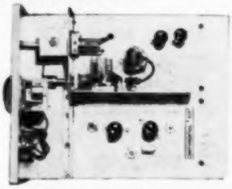

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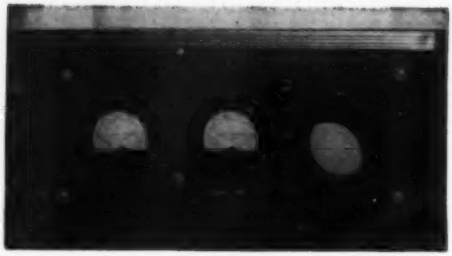


John T. Reeder
WØMWJ
Route 1
Kennett, Mo.

Linear Scope Monitor

ONCE the excitement of getting the big gun on the air has subsided and you are satisfied that you are getting out, there eventually comes a time when the SSB operator begins to wonder just what his signal looks like.

This is one approach to getting a visual monitor, using a minimum of readily available parts and it can be incorporated as a permanent part of the rig.

This is not an all purpose scope. It is designed to produce a trapezoid pattern for monitoring a linear amplifier.

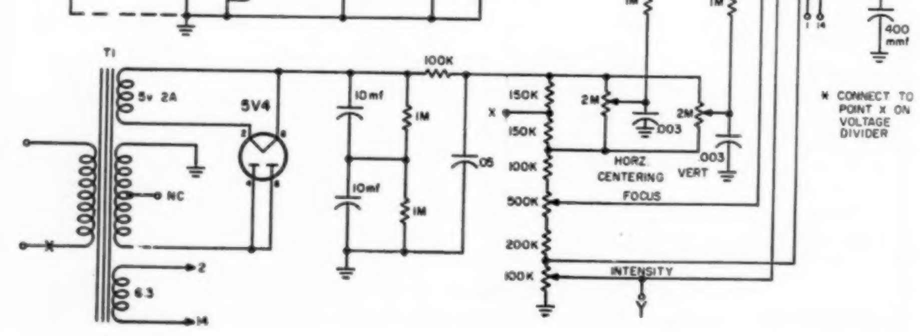
A sample of the signal from the exciter is taken off through a "T" connection between the exciter and the input to the final. This signal is rectified and filtered by the 1N58A's in series and associated circuit. Two diodes were used to provide ample voltage to drive the deflection plates of the scope tube without further amplification. The voltage divider at the input to the diodes sets the width of the pattern on the scope tube and must be re-set for each band.

Vertical deflection is derived by a simple rf pick-up from the final tank coil. A piece of insulated wire looped through the turns of the final coil can be adjusted to produce the correct amount of drive to match the input to the horizontal plates.

If the final output is linear with the input you get a nice straight sided triangle. Overmodulation and loading difficulties show up readily.

A blocking bias can be applied to point "Y" from the exciter to provide cut-off of the beam during periods of stand-by to prevent burning the picture tube. Or, if you're not fussy, simply turn down the intensity after you have tuned up and are operating. If you change bands or move enough to re-load, it's a simple matter to turn up the intensity and say HALO a time or two while watching the scope.

The construction can be adapted to match your rig. In our case the rig had a meter panel


T-MATCH
EXCITER
FINAL
3X2X2
HANDI-BOX
47Ω
2W
100K
(2) IN58A
2.5 MH
2.5MH
.005
.005
27K
RF PICK-UP
3BP1
11
8
7
10
9
5
2
*
1M
1M
1
14
400 mmf
T1
5v 2A
5V4
2
8
4
6
NC
6.3
2
14
100K
10mf
10mf
1M
1M
.05
150K
X
150K
100K
500K
200K
100K
2M
2M
.003
.003
HORZ.
CENTERING
VERT
FOCUS
INTENSITY
Y
* CONNECT TO POINT X ON VOLTAGE DIVIDER

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which included a thermo-couple RF meter that didn't tell us much. The scope tube was mounted to occupy the hole left when we took the meter out. The works were mounted on a "U" shaped chassis from an old BC-191 tuning unit. The panel controls were sub-Mounted on a strip of bakelite and extended through the front panel with polystyrene rods.

All resistors are 1 watt unless otherwise noted and the condensers should be chosen to match the voltage encountered at the point of use. The voltage divider potentiometer in the horizontal pick up unit is a TV insulated shaft model to prevent rf break-down. The power transformer can be any available small receiver type which will produce about 800 volts total in the high voltage winding. This voltage will produce sufficient intensity for easy observation in room light and allows direct drive of the deflection plates without amplification.

Two tubes and a few parts from your junk box and you're sure your final is clean.

. . . WØMWJ

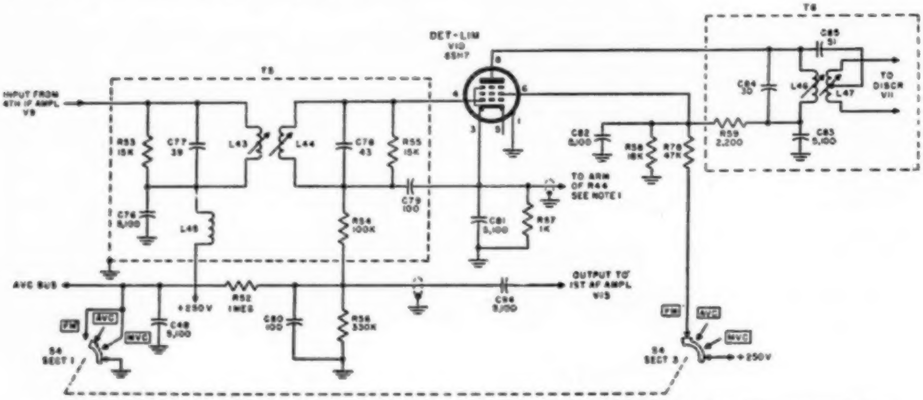
FM to AM

A recurring problem in surplus application is the conversion of an FM receiver to receive AM signals. This requirement often demands that the original FM circuitry be retained and either AM or FM reception be possible on a switched basis. Although many approaches to this problem have been employed, the circuitry is often complicated and the results are not always the best.

This problem is solved in a very straightforward manner in some of the older military equipment. The SCR-616 Radio Receiving Set, which used either the BC-1269, BC-1269A or the R-593/GRR Radio Receiver, is the case in point. In these receivers, the audio component developed across the limiter grid resistor is used to drive the audio amplifier directly. In addition, the dc component developed is filtered and used as the AVC voltage source in the AM mode of reception.

The schematic diagram shows this application in detail. There is nothing sacred in the component values shown or in the switching circuit used. Normal precautions in the area of AVC isolation and filtering should be observed. Also, unless excessive distortion or signal leakage occurs, there should be no requirement for removal of the limiter plate voltage in the AM mode. The technique described has considerable merit and should have wider application than is now the case.

. . . W4WKM


DET-LIM
V10
6SH7
T5
T6
INPUT FROM
6TH IF AMPL
V9
R53
15K
C77
39
L43
L44
C78
43
R55
15K
C76
5,100
L45
C79
100
R54
100K
C81
5,100
R57
1K
TO ARM
OF R44
SEE NOTE 1
C82
5,100
R58
18K
R76
47K
R59
2,200
C84
30
C85
51
L46
L47
C83
5,100
TO
DISCR
V11
AVC BUS
+250V
R52
1MEG
C80
100
R56
330K
C48
5,100
C86
5,100
OUTPUT TO
1ST AF AMPL
V13
FM
AVC
MVC
S4
SECT 1
S4
SECT 3
+250V

AM detector circuit for FM surplus Gear. Note: Cathode of V10 is grounded by R44 for AM reception.

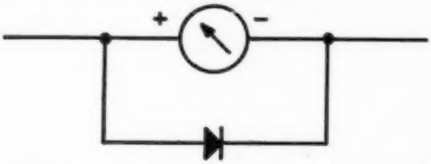
Don't Wreck That Meter

Fred Conner W9CUK

A recent article in 73 described a method of protecting meters from burnout. Perhaps an elaboration of this will be of interest.

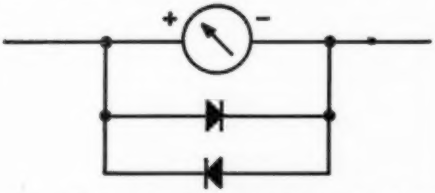
Probably each of us has at one time or another overloaded an instrument. Simple fusing will not prevent burnout, or bent pointers in the case of severe overload.

Let us examine the ordinary direct current meter movement. Most milliammeters, microammeters, and ammeters have a full scale deflection voltage of 0.1 V, or less. Inquiries to meter manufacturers, and tests on typical meters indicate that overloads of about 10 times normal full scale voltage, or 1 volt, will seldom damage coils or pointers. Now, most silicon diodes have a very high resistance at 0.1 volts. However, as forward voltage across the silicon diode exceeds about 0.1 volts, the diode resistance becomes relatively low and, until the diode current reaches a level greatly exceeding the current rating of the diode, will seldom exceed a volt. Extreme overload will cause the diode to short rather than open.



In Fig. 1 the diode is paralleled with the meter terminals. This may be a meter in current measuring usage or a voltmeter, bridge, etc. At normal meter full scale or less the diode will not effect the meter accuracy, however, in overload the diode will clamp at less than harmful currents and no damage will ensue to either meter or diode, up to the current rating of the diode. When the overload is removed, everything will be normal and undamaged.

The ordinary inexpensive "top hat" silicon power diode of ½ ampere and about 400 v PIV rating will protect even sensitive microammeters up to 500 ma. or more. At great surge or overload the diode will short and be destroyed but will still save the meter. Where a possibility of greater current exists, diodes of larger ratings may be employed. Fig. 2 shows the use of 2 diodes. Here, as is not true in Fig. 1, overload of any polarity will not cause meter damage. Circuit 2 will also protect against any ac overloads, within the limitations of the diodes.



In conlusion, mention is made of experience in a large communications manufacturing plant. For the past several years the methods described above have virtually eliminated burnt out or bent pointer damage in many pieces of factory equipment which are normally subjected to frequent and severe overloading. Sensitive meter type relays have also been thus protected with complete elimination of previous frequent and costly damage.

. . . W9CUK

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$3.00 2500 kc to 15,000 kc, fundamental frequencies 15 mc to 30 mc, third mode

$3.50 30 mc to 50 mc

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Citizens Band transmitter crystals in stock for the following equipment: JR-800, 761A, CD1, GW10, CD5, CD100, CD100A, TR330, C27, AT20, Messenger, MK7, R2700, TR910, 27C2, ED27, CR117, CDD5, CT1, RP115, CD27, TECT. Guaranteed .004% of nominal: $3.00.

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Louis Hutton WφRQF
2608 South Fern
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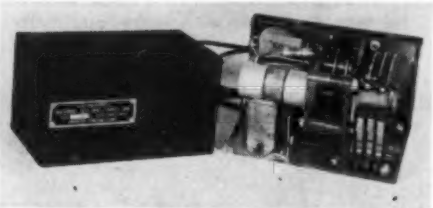
The Band Warmer



THIS modification to the Keyer KY-65/ARA-26 provides the builder with a unit that will automatically key a transmitter in the CW mode or will modulate a transmitter in the MCW mode. Code discs are used to determine the message sent.

The KY-65/ARA-26 Keyer is available from several surplus houses. I purchased mine from R & W Electronics, Chicago, Illinois. The first thing I did was strip out all parts down to the bare chassis. A new overlay panel was fabricated for the front of the box to cover up the connector holes and improve appearance. The motor and disc assembly was disassembled, cleaned, and the micro-switches removed from the frame.

AUTO. KEY OUTPUT
POWER
OFF
ON
M.C.W.
C.W.
THE BAND WARMER

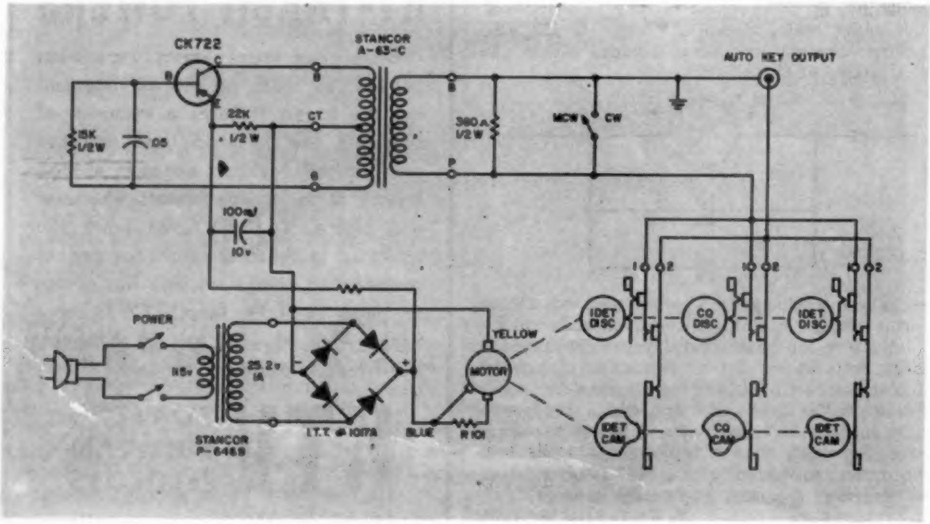
A bracket of aluminum was formed to support the transistor audio oscillator output transformer, selenium rectifier, and terminal strip. It is mounted underneath the motor next to the power transformer. The CK-722 transistor is supported by its leads attached to the terminal strip. The SOS disc and the plastic code disc were replaced with new discs. The disc in the SOS position now sends DE-WφRQF and the identification disc sends WφRQF. The center disc is usable as is or may be replaced with one cut to send CQ. The new discs should be filed and sanded as smooth as possible to prevent excessive wear to the wiping contacts on the keyer assembly.

When using the unit in MCW mode on the VHF bands, the output is connected to the telephone patch or microphone input of the modulator.

On the HF bands in the CW mode the output is plugged into the key jack of the transmitter.

This gadget is very handy on VHF DX contests, warming up the band, equipment testing, and propagation studies—any other ideas?

. . . WφRQF


CK722
B
C
E
15K
1/2W
.05
22K
1/2 W
CT
STANCOR
A-63-C
380Ω
1/2 W
S
P
100μf
10v
AUTO KEY OUTPUT
MCW
CW
POWER
115v
25.2v
1A
STANCOR
P-6469
I.T.T. # 1017A
YELLOW
MOTOR
BLUE
R 101
1
2
IDET DISC
CQ DISC
IDET DISC
IDET CAM
CQ CAM
IDET CAM

Home Brew Bridge Calibration

This table is useful for all homebrew SWR bridges and gives the % reflected power and the % full scale reading in the reflected mode, when the meter is set at full scale in the forward mode.

SWR	% Pwr. Refl.	Refl. Rdg. in % of Full Scale
1.1	.2%	4.8%
1.2	.8	9.1
1.3	1.7	13.1
1.4	2.8	16.7
1.5	4.0	20.0
1.6	5.3	23.1
1.7	6.7	25.9
1.8	8.2	28.6
1.9	9.7	31.1
2.0	11.0	33.3
2.1	12.6	35.5
2.2	14.0	37.5
2.3	15.5	39.4
2.4	17.0	41.2
2.5	18.4	42.9
2.6	19.7	44.4
2.7	21.1	45.9
2.8	22.5	47.4
2.9	23.8	48.7
3.0	25.0	50.0
4.0	36.0	60.0
5.7	49.0	70.0
9.0	64.0	80.0
19.0	81.0	90.0

. . . W4OAB

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double conversion, mechanical filter selectivity, extreme stability; all the features you want and need for only $289.50 ready to go. Write for full information on the receiver and associated exciter-linear units.

(Our orders are still on a waiting-list basis, and thanks again for your tremendous interest in our new product line!)

davco *electronics company*
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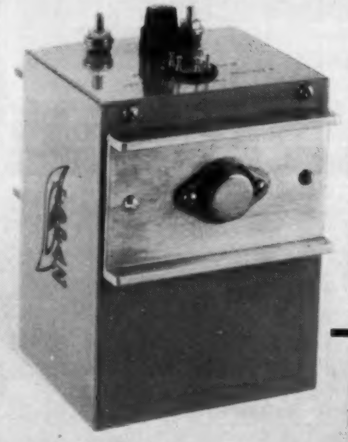
TOPAZ 250 WATT CONVERTERS



- Short circuit protected
- Compact — only 3 15/16" x 4 5/8" x 6 1/8"
- Epoxied magnetic components
- Epoxy fiberglass printed circuit board
- Accessible resistors, condensers and transistors
- Regulated drive power for extra long life and high efficiency
- Unconditionally guaranteed against defects in materials and workmanship for a period of 6 months

MOBILE POWER AT EXCEPTIONALLY LOW COST

Topaz Static Converters operate the majority of mobile transmitters and receivers. Through new concepts in converter circuitry* these units deliver more watts per dollar than any comparable unit. In addition, they are smaller and lighter in weight, and higher in efficiency. This means increased savings through longer life of batteries and generators.

New models are now available designed specifically for or adaptable to the following applications:

C10W	C10WG	C10WDG	C10WDD	C10XDG
600 vdc (.415A) 300 vdc (.5A) 120 vac 400 cps	600 vdc (.415A) 300 vdc (.5A) 0-120 vdc bias	600 vdc (.415A) 300 vdc (.5A) 0-120 vdc and Relay	650 vdc (.325A) 270 vdc (.13A) LC filter and 2 Relays	800 vdc (.325A) 280 vdc (.21A) LC Filter and Relay −50 to −90 vdc bias
Johnson Viking Mobile	Collins KWM-2	Swan, all models, Collins KWM-2	Gonset "G-76"	Collins KWM-1, 2
$79.50	$89.50	$99.50	$119.95	$134.95

NOTE: Any combination of above outputs — up to 250 VA total maximum, except C10XDG — 260 watts.

GENERAL SPECIFICATIONS FOR ALL MODELS

Input requirements:	Voltage 11-15 VDC, 13 volts nominal
Efficiency:	85%
Weight:	Approximately 7 lbs.

*Patent Pending.

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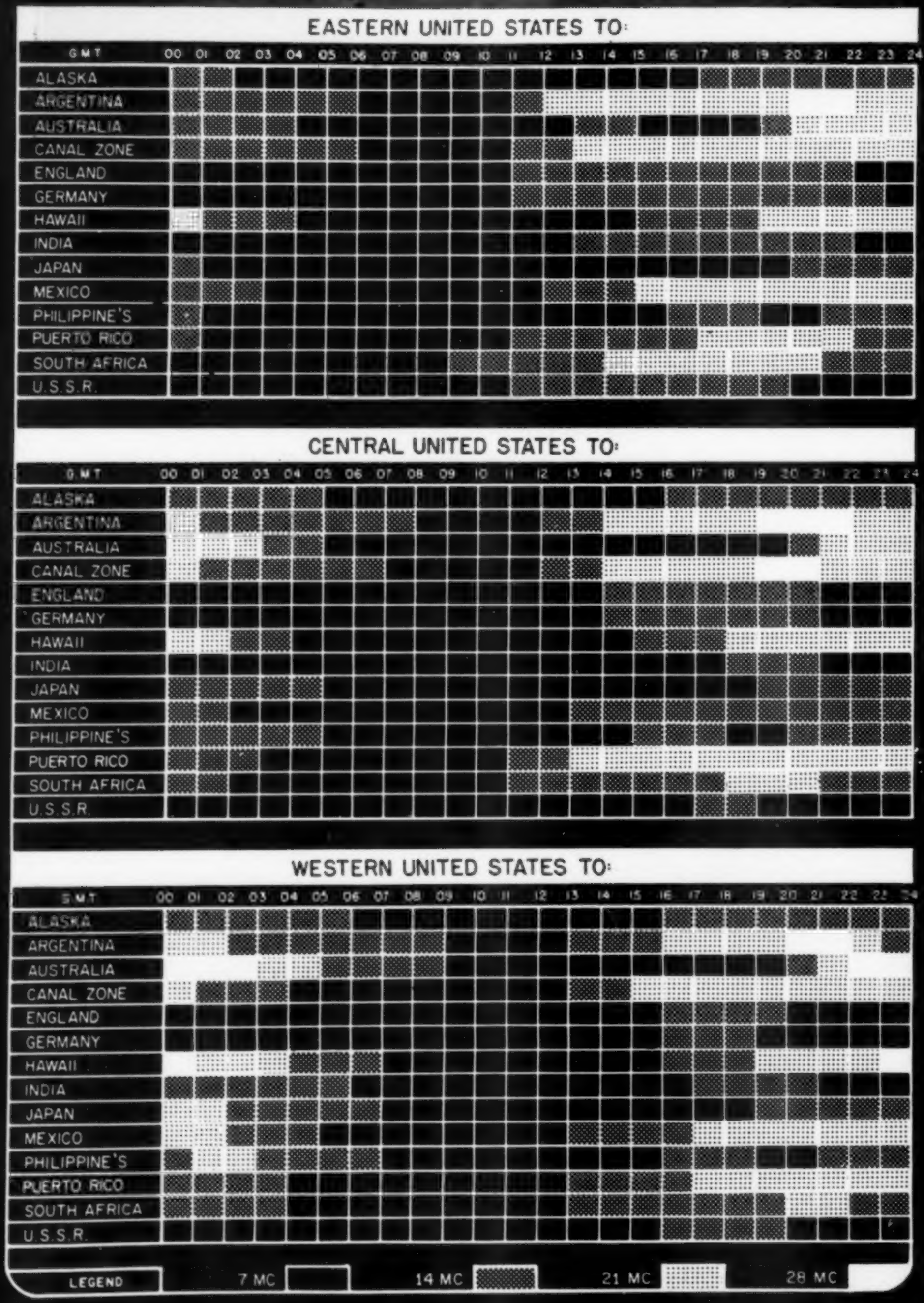
PROPAGATION CHART



EASTERN UNITED STATES TO:

G M T	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23 24
ALASKA	▨	▨	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨
ARGENTINA	▨	▨	▨	▨	▨	▨	■	■	■	■	■	▨	░	░	░	░	░	░	░	░	□	□	░	░
AUSTRALIA	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	■	■	■	■	▨	░	░	░	░
CANAL ZONE	▨	▨	▨	▨	▨	▨	■	■	■	■	■	▨	▨	░	░	░	░	░	░	░	░	░	░	░
ENGLAND	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	■	■
GERMANY	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	■
HAWAII	░	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	░	░	░	░	░
INDIA	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	▨	▨	■	■
JAPAN	▨	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨
MEXICO	▨	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	▨	░	░	░	░	░	░	░	░	░
PHILIPPINE'S	▨	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	■	■	▨	▨	▨
PUERTO RICO	▨	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	░	░	░	░	░	▨	▨
SOUTH AFRICA	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	░	░	░	░	░	░	░	▨	▨	▨
U.S.S.R.	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	▨	▨	■	■	■	■

CENTRAL UNITED STATES TO:

G.M.T	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23 24
ALASKA	▨	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	▨
ARGENTINA	░	▨	▨	▨	▨	▨	▨	▨	■	■	■	■	▨	▨	░	░	░	░	░	□	□	□	░	░
AUSTRALIA	░	░	░	▨	▨	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	░	░	░
CANAL ZONE	░	▨	▨	▨	▨	▨	▨	■	■	■	■	■	▨	▨	░	░	░	░	░	□	□	░	░	░
ENGLAND	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	■	■	■
GERMANY	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	■	■	■
HAWAII	░	░	▨	▨	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	░	░	░	░	░	░
INDIA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	■	■	■
JAPAN	▨	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨
MEXICO	▨	▨	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
PHILIPPINE'S	▨	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	■	■	▨	▨	▨	▨
PUERTO RICO	▨	▨	▨	■	■	■	■	■	■	■	■	▨	▨	░	░	░	░	░	░	░	░	░	░	░
SOUTH AFRICA	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	░	░	░	▨	▨	▨
U.S.S.R.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	■	■	■	■	■

WESTERN UNITED STATES TO:

G.M.T	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23 24
ALASKA	▨	▨	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	▨
ARGENTINA	░	░	▨	▨	▨	▨	▨	▨	▨	■	■	■	■	▨	▨	▨	░	░	░	░	□	□	░	▨
AUSTRALIA	□	□	□	░	░	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	■	▨	░	□	□
CANAL ZONE	░	▨	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	░	░	░	░	░	░	░	░	░
ENGLAND	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	■	■	■	■
GERMANY	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	■	■	■	■	■
HAWAII	□	░	░	░	▨	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	▨	░	░	░	░	□
INDIA	▨	▨	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	■	■	■
JAPAN	░	░	▨	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨
MEXICO	░	░	▨	▨	▨	■	■	■	■	■	■	■	■	▨	▨	▨	▨	░	░	░	░	░	░	░
PHILIPPINE'S	▨	░	░	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	▨	■	■	▨	▨	▨
PUERTO RICO	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	░	░	░	░	░	░	░
SOUTH AFRICA	▨	▨	▨	▨	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	▨	▨	▨	░	░	▨	▨
U.S.S.R.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▨	▨	▨	▨	■	■	■	■

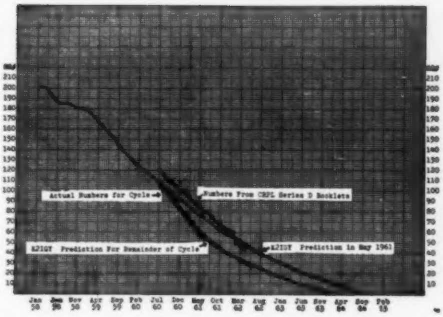
LEGEND	7 MC	14 MC	21 MC	28 MC
	■	▨	░	□

Propagation Charts

David A. Brown K2IGY
30 Lambert Avenue
Farmingdale, N. Y.

For the DX propagation chart, I have listed the HBF which is the best Ham Band Frequency to be used for the time periods given. A higher HBF will not work and a lower HBF sometimes will work, but not nearly as well. The time is in GMT, not local time.

The Short Path propagation chart has been set up to show what HBF to use for coverage between the 48 states. Alaska and Hawaii are is somewhat different than the DX chart. First, the time is the local time centered on the mid-point of the path. Second, the distance given in miles is the Great Circle path distance because of the Earth's curvature. Here are a couple of examples of how to use the chart. A.) To work the path Boston to Miama (1250 miles), the local time centered on the mid-point of the path is the same in Boston as in Miama. Looking up the HBF's next to the 1250 mile listings will give the HBF to use and the time periods given will be the same at each end of the circuit. B.) To work the miles), the local time centered on the mid-point of the path will be 1½ hours later than at San Francisco and 1½ hours earlier than in New York (the time difference between New York and San Francisco is 3 hours). Looking up the HBF's next to the 2,500 mile listings will give the HBF to use. In San Francisco subtract 1½ hours from the time periods listed for local time and in New York add 1½ hours to the time periods listed for local time.



Advance Forecast: April 1962

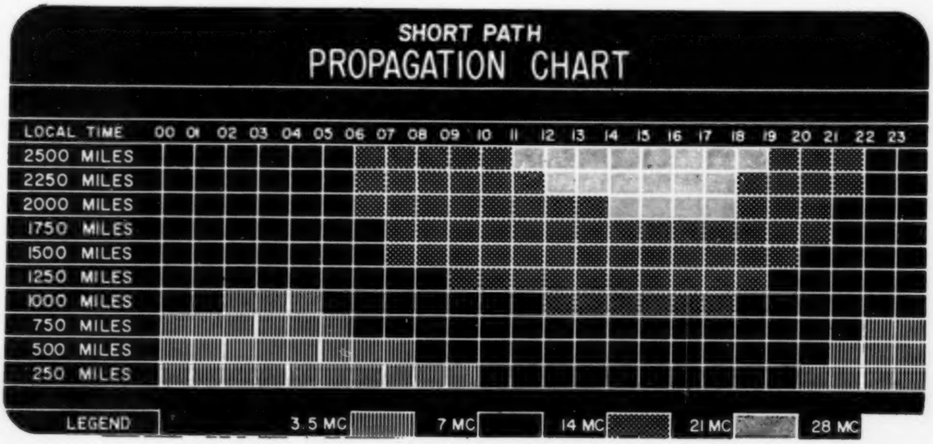
Good: 8-11, 17-20, 23-29

Fair: 1-3, 6-7, 12-13, 15-16, 21, 30

Bad: 4-5, 14, 22

Things could be worse

SHORT PATH PROPAGATION CHART



LOCAL TIME	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2500 MILES	■	■	■	■	■	■	▦	▦	▦	▦	▦	░	░	░	░	░	░	░	░	▦	▦	▦	■	■
2250 MILES	■	■	■	■	■	■	▦	▦	▦	▦	▦	▦	░	░	░	░	░	░	▦	▦	▦	▦	■	■
2000 MILES	■	■	■	■	■	■	▦	▦	▦	▦	▦	▦	▦	▦	░	░	░	░	▦	▦	▦	■	■	■
1750 MILES	■	■	■	■	■	■	■	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	■	■	■
1500 MILES	■	■	■	■	■	■	■	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	■	■	■	■
1250 MILES	■	■	■	■	■	■	■	■	■	▦	▦	▦	▦	▦	▦	▦	▦	▦	▦	■	■	■	■	■
1000 MILES	■	■	▥	▥	▥	■	■	■	■	■	■	■	▦	▦	▦	▦	▦	▦	■	■	■	■	■	■
750 MILES	▥	▥	▥	▥	▥	▥	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▥	▥
500 MILES	▥	▥	▥	▥	▥	▥	▥	▥	■	■	■	■	■	■	■	■	■	■	■	■	■	▥	▥	▥
250 MILES	▥	▥	▥	▥	▥	▥	▥	▥	▥	▥	■	■	■	■	■	■	■	■	■	■	▥	▥	▥	▥

LEGEND 3.5 MC ▥ 7 MC ■ 14 MC ▦ 21 MC ░ 28 MC

Technical Manuals for Surplus Equipment

Non-availability of technical information on surplus military electronics equipment has long been a serious problem. While certain surplus dealers specialize in the sale of such manuals, the selection is anything but complete. The Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C., is one source of manuals published by the military services but, once again, the selection is very small.

Manuals stocked are limited to general reference books and texts and few, if any, instruction manuals on specific equipments are available from this source. Publications on the general subject of radio are listed in several price lists which may be obtained by writing the Superintendent of Documents. Price lists PL 19 (Army), PL 63 (Navy) and PL 82 (Radio) are pertinent. Of the 22 Signal Corps Technical Manuals listed by GPO in PL 19, 19 are general reference manuals or training texts and 3 deal with air navigational facilities.

Incidentally, one item in PL 19 is deserving of special mention. Army Technical Manual, TM 11-690, "Basic Theory and Application of Transistors," at $1.25, is a very fine buy. This book packs a lot of information in its 263, 8" x 10" pages. This book starts with the basic principles of solid state devices and carries you through advanced circuits.

One little used and quite productive source of current Army Technical Manuals is the Department of the Army, Office of the Adjutant General, Washington 25, D. C. Unfortunately, this office does not publish a listing of publications that are available for sale since the status and price varies unpredictably. Of the unclassified, current Signal Corps Technical Manuals, approximately half may be bought from this source. The balance may not be sold, either because of limited stocks or because they contain copyrighted or proprietary material.

Manuals are still stocked for some of the World War II, and earlier, equipment, although availability is quite spotty. One category of equipment poses almost insurmountable problems. Old Army Air Corps equipment manuals that were phased out of Army channels and not picked up by the Air Force are simply not available. The publications should be ordered by number to insure that you get what you want. This may be a problem, although most Army surplus equipment has a warning plate or decal installed which reads something like "Before Operating This Equipment, Review TM 11-....."

All in all, the AG source is quite productive and it is certainly worth a letter to the Department of the Army to determine the status of the manual you need. Address your request to the above listed Washington office, attention: AGAM.

Those who live in the Washington area may take advantage of the services offered by The Library of Congress. Extensive microfilm files of military publications are maintained and photographically reproduced copies of a single page or an entire publication may be purchased. Prices are in line with commercial charges for photostats, so reproduction of a complete manual would probably be prohibitively expensive. However, a single schematic diagram could well meet your requirement and, for a single page, the cost is within reason.

. . . W4WKM

QTH AMATEUR RADIO LOCATION MAP
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Precision Measurement for the Amateur

Roy Pafenberg W4WKM

As his construction projects become more complex, the amateur often discovers that the general run of test equipment designed for the service industry does not completely meet his requirements. In addition to the generally accepted lack of accuracy existing in the trade instruments, there are certain circuit parameters and component characteristics which are simply not measurable with equipment of that category. If at this time the basement work shop amateur is exposed to the test equipment and techniques of a modern research or engineering activity, his dissatisfaction with his own equipment and methods increases space.

The cost of laboratory instruments to equip a small electronics engineering or development shop with the basic minimum of modern test instruments can easily exceed $25,000. This figure does not include specialized equipment for work in such areas as microwave, but is limited to general purpose instrumentation. Obviously, such an investment is not warranted for even the most inveterate amateur constructor.

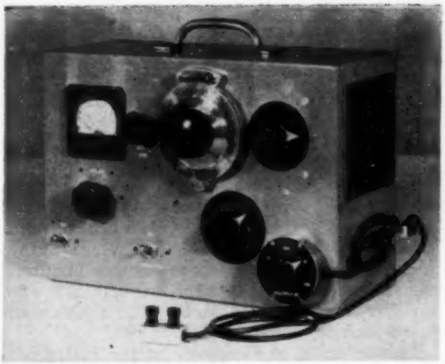
A review of the precision instrument catalogs of the last two decades will reveal that many types of instruments have increased in cost far more than the shrinking purchasing power of the dollar would justify. Comparison of formerly available instruments with the current crop does not, in most cases, show any great improvement in basic accuracy. While there have been some changes in the approach to precision measurement. most instruments have simply become more complex in order to provide increased operating convenience and to conserve valuable engineering time.

Good examples of this developmental trend may be found in the field of audio and radio frequency measurement. Frequency meters, along with primary and secondary frequency standards, have been available for years and the basic limitation on accuracy has been that of the standard or calibration oscillator. These instruments, through the use of transfer and interpolation oscillators, detectors and indicators, can precisely determine the frequency of an unknown signal. Frequency counters were then developed to speed up these measurements. These instruments, using computer techniques, continuously and repetitively display the frequency of the signal being measured by means of read out indicators on the front panel of the instrument. This instrument saved much manpower, however a technician or engineer was still required to read and record the readings displayed. To eliminate this requirement, the recording printer was developed for use with the frequency counter. This device prints, at any previously determined rate, the frequency read by the counter.. The precision, convenience and lack of human error of these automated instruments leads to a great saving of engineering and scientific manpower in research and developmental testing.

While most amateurs would undoubtedly desire to possess such instruments, the initial cost and the maintenance required by such complex equipment would, in most instance, be prohibitive. However, all is not lost. The ubiquitous kit manufacturers have made available, at very reasonable cost, a wide variety of laboratory type test equipment. These instruments, for the most part, are adequate for amateur, experimental and routine production work. They fill a definite requirement for better performance than the common service equipment and sell at a price most amateurs can afford. Examples are the Heathkit laboratory signal generator, wide band oscilloscope and ac voltmeter which perform the same functions as their service instrument counterparts, but with increased precision and accuracy. While their performance may not equal that of the best commercial laboratory equipment, it is fully adequate for most purposes. Rarely are laboratory instruments operated in such a manner as to obtain the accuracy of which they are capable and, if this accuracy is obtained, it is often meaningless since other variables may well be the limiting factors.

Another category of kit laboratory type instruments permits measurement of circuit paramaters and component characteristics not measurable with equipment designed for the service industry. Examples are the Heathkit impedance bridge and the laboratory Q-Meter. Once again, these instruments are fully adequate for routine experimental and production work.

Used and military surplus equipment should not be ignored by the amateur interested in obtaining better than average instruments. The laboratory test equipment of the last decades was usually built to last a lifetime.



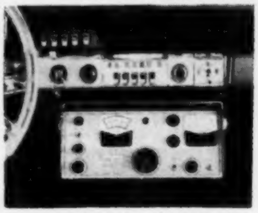
Ferris 'Microvolter' signal generator, completely rebuilt. A spray lacquer finish and commercial decals restored the instruments appearance.

Simple circuitry, coupled with rugged mechanical design and precision components, resulted in equipment that was practically invulnerable to normal use and that would resist much actual abuse. Private industry, educational institutions and the Armed Forces are continually disposing of older precision test equipment and a wide variety is available to those who will search for it. Much of this equipment is in the hands of dealers and is often very reasonably priced. It is an interesting commentary on our present economy, but some of this used equipment is a bargain at the price it originally sold for many years ago.

Rather than wait for specific instrument requirements to arise, the amateur is advised to be continually on the lookout for the good buys and to purchase the more desirable equipment as it becomes available. It is axiomatic that the person buying to meet an immediate need will pay more than one who is able to wait and choose from the best as it filters into the market.

A few pointers are in order on the selection of instruments from those that may be found. Beware of paying undue attention to external appearance. Equipment being disposed of almost invariably suffers a period of neglect prior to disposition. Deterioration of the external surfaces is usually the first indication of this lack of care. Internal condition is of greater importance, since the instrument may be easily cleaned, polished and even painted if required. Of course if the equipment is working, try it out. Check operation, completeness and, if possible, calibration. Bear in mind, though, that an instrument displayed in working condition and inviting an operational check will usually demand a premium price.

The approach that has proved most feasible in the acquisition, rehabilitation and improvement of older laboratory test gear can best be illustrated by following through a specific ex-



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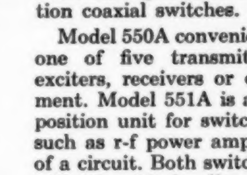

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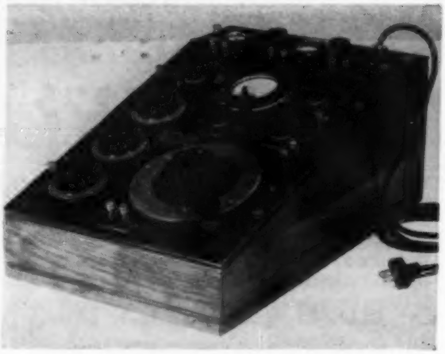


The renovated General Radio Type 650A Impedance Bridge with the fabricated null detector-indicator installed.

ample. The writer had the opportunity to purchase a General Radio Company Type 650-A Impedance Bridge in what appeared, at first glance, to be in very poor condition. Since the price was extremely reasonable and a genuine and immediate requirement existed for such an instrument, the transaction was completed.

The General Radio 650-A Impedance Bridge is powered by self contained batteries and uses an internal galvanometer as null detector for the dc resistance ranges. The ac functions of the bridge use an internal 1000 cycle tone source but requires the use of an external null detector. Ranges provided are as follows:

Function	*Value*		*Accuracy*	
	Minimum	*Maximum*	*Maximum*	*Minimum*
Resistance ..	.01 ohm	1 megohm	1%	2%
Capacitance .	1 uuf	100 uf	1%	2%
Inductance .	1 uh	100 h	2%	10%
Dissipation factor	.002	1	5%	20%
Storage fact.	.02	1,000	5%	20%

The photograph shows one model of this instrument. It is well built, with a ¼" aluminum panel and is housed in a copper lined, mahogany case. The interior is typical General Radio quality, using solid bare wiring, large precision potentiometers and other components representative of laboratory instruments. Correspondance with General Radio disclosed that the Type 650-A Impedance Bridge was introduced in May of 1933 at a price of $175.00. At the time of its discontinuance in 1959, this instrument was selling for $285.00. It is interesting to note that, by building to the highest quality standards and by using simple, straightforward circuitry, this device could remain, relatively unchanged for a period of 26 years, the undisputed standard of the industry.

The Type 650-A Impedance Bridge was finally replaced by the Type 1650-A in 1959. This instrument is completely self contained, with internal batteries, transistorized tone source, null amplifier-detector and indicator. While the new instrument claims greater operating convenience, increased range and improved accuracy, the March, 1959 issue of "The General Radio Experimenter" noted that the fundamentals of good instrumentation still apply: "While specialized and unusual circuits often have advantages for single-purpose bridges, no satisfactory replacements have been found for the simple, classical circuits in a general-purpose bridge. Their accuracy and simplicity are difficult to surpass for direct measurements of inductance, capacitance, storage factor, dissipation factor, and both dc and ac resistance."

Inspection of the exterior of the instrument seemed to confirm a reported history of 15 years hard service. The panel paint was chipped and the aluminum eroded, the case was damaged and the dials were unreadable because of corrosion and dirt. The interior of the bridge told a completely different story. The typical General Radio odor, compounded of high quality Bakelite and honest rosin flux, was noted when the case was opened and appearance was as good as new. Although the lubricant used on the switches and potentiometers had hardened, there was no visible mechanical damage of any kind and a hasty continuity check disclosed no defective components.

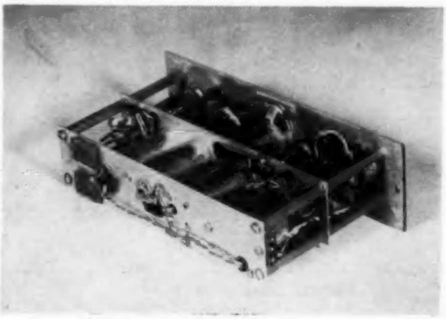
The necessary cabinetwork was accomplished first. The instrument panel was removed, hardware stripped from the case and the old finish removed with paint and varnish remover. The case was sanded smooth, a coat of sealer applied and lightly sanded, followed by two coats of clear lacquer which provided a finish indistinguishable from a factory job. The handle was given a flat black lacquer finish and was installed, using new screws. New rubber feet, screwed to the bottom of the case, completed the cabinet.

Next, all control dials, knobs and their associated hardware were removed and thoroughly cleaned in a solvent bath. Both the Bakelite and nickel plated surfaces were buffed to a high luster on a buffing wheel. Buffed coats of Simoniz restored this hardware to new condition. The instrument proper was then given the solvent treatment. Brushes and cloths were used to remove all traces of grease, dirt and corrosion from the panel and interior components. Extreme care was used to avoid damage to the fragile potentiometers and other parts. After the instrument was completely dry, contacts and moving parts were carefully lubricated with Vaseline.

The front panel now received attention. Corrosion was scraped from the panel where chipped paint had exposed the bare aluminum. Matching flat lacquer was carefully puddled into the resultant depressions in the wrinkle finish. After the lacquer was dry, two coats of Simoniz, buffed to a high gloss finish, completed renovation of the front panel. The knobs, dials and other hardware were then installed.

The completed instrument was connected to a battery source and a pair of headphones. A few quick checks showed that the dc bridge was operating properly, although no ac measurements could be made. Tests disclosed that the microphone hummer, identified as 0-1 in Figure 1, was not oscillating. Adjustment of the microphone button linkage restored its operation to normal and the bridge functioned on the inductance and capacitance ranges.

There is nothing sacred in the approach described above. Actual work required will differ in each case and there are many methods that may be used. Common sense, lots of elbow grease and careful attention to detail will lead to good results. The writer was fortunate in the example cited as no component replacement was required. Such replacements, if necessary, usually pose no serious problem. Rugged simplicity is the keynote in design of such equipment and repairs, either electrical or mechanical, are not too difficult. The increasing availability, from local outlets, of precision components in a very wide range of values, greatly simplifies such repairs. The occasional special part that is required may generally be obtained from the manufacturer and, while prices on these components are high, the value of the end product usually justifies the expenditure.



The impedance bridge power supply and amplifier-indicator unit. Note the extreme versatility of the 'post and plate' type of construction.

Once the equipment is restored to mechanical newness and the obvious electrical faults corrected, access to precision measurement instruments will permit adjustment of calibration circuits and verification of the over-all accuracy of the repaired device. All is not lost if you do not have the required instruments in your own shop. In todays diversified industry, it is not at all unusual to have a precision electronics laboratory just around the corner. Schools and other institutions also have precision measuring equipment which may be made available. Social contacts or a casual conversation at the local ham club will often

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The appearance of this amplifier-indicator assembly, ready for installation in the General Radio Type 650 Impedance Bridge, is enhanced by the use of commercial decals.

produce the required equipment.

Calibration of reconditioned equipment is not as difficult as would be expected. The calibration of most instruments can be restored to normal by calibrating at a single reference point for each range of the equipment. An example of this line of thinking may be cited by assuming a laboratory signal generator for which the accuracy of the calibrated output level is questioned. A resistance check shows that the step and variable attenuator resistors are near their proper values. Setting the calibration adjustment to produce a measured output voltage equal to that indicated by the attenuators, on a single frequency and at a single output level, will probably hold good for all frequencies and all output levels within the range of the instrument.

While the results that can be obtained with the older instruments have been covered, minor modifications and additional features can greatly enhance the value of such equipment. The General Radio Type 650-A Impedance Bridge provides a good example of this. While this instrument had been restored to its original condition, it still left something to be desired in operating convenience. Use of the internal batteries was expensive and presented a recurring maintenance problem. Headphones, used as the null detector, were awkward and were relatively insensitive.

The panel access battery compartment, measuring 6⅞" x 2¾" x 10⅞", provides sufficient room to install a low voltage dc bridge supply, selective audio amplifier, null indicator, loudspeaker and power supply. The photographs show assembly details of the added unit and its installation in the renovated bridge. The "post and plate" method of construction shown is ideally suited to modification work where available space may prohibit use of the conventional chassis and panel approach. This added assembly is shown as an example of a successful approach to instrument modification and the convenience of the self contained null detector and indicator more than justifies the cost and effort.

Basically, the circuit consists of one half of a 12AT7 as an input amplifier, followed by the other section of this tube as a phase-shift, selective feedback amplifier. Standard tolerance components are used to roughly tune the phase shift network to the bridge oscillator frequency and feedback is set just short of oscillation by selection of resistor "R". This stage is coupled to a 6E5 indicator tube for visual indication of bridge balance and to a 6C4 amplifier stage which feeds a small PM speaker.

Other categories of instruments may require different approaches to their repair and modernization. The end result of another renovation project is shown is the photographs. The signal generator is one of the family of "Microvolter" HF and VHF laboratory generators manufactured by the Ferris Instrument Corporation of Boonton, New Jersey. These instruments were used in great quantities during the last war and are widely available on the surplus market. The case and panel of this particular unit was in poor condition and complete refinishing was required. A spray lacquer finish and the use of commercial marking decals gave the instrument a "good as new" appearance. The rf section of the generator was in very good condition and the only work required was replacement of the output cable and cleaning of the band change turret and attenuator contacts. The power supply chassis was another story since all capacitors required replacement. Surplus, oil filled units were installed in the line filter assembly. New wiring was installed between the sub-assemblies. The unit was checked out and performance found equal to that of a new instrument.

This article has described the advantages that can accrue from the use of kit instruments and older, precision test equipment. It has further demonstrated how a laboratory may be assembled on a limited budget. Application of the techniques outlined herein should result in a high degree of success; broaden the experience and increase the capability of any amateur who enters into this field of endeavor.

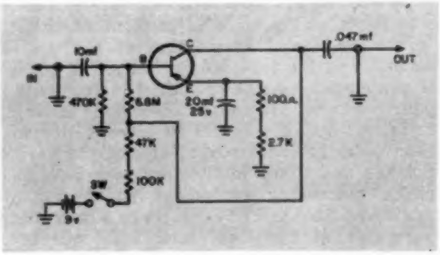
. . . Pafenberg

Letter

Dear Wayne,

The transistor mike preamp (p. 10, November 73) was rather interesting. Naturally I put one together to use with my Gonset II. I cut the distortion from 2.8% to about half of that by making a few small changes in the circuit, as follows:

LeVaughn Shipley K6CFF



(Finland from page 19)

due to the fact that they *must* have certain number of CW contacts before they are allowed to pass the General Class examination.

SRAL Board consists of the President plus nine members. SRAL Bureau has a regular personnel of one man (OH2XK) in full-day work, and the Secretary, Magazine Editor, Treasurer etc. just take their share of the activities in their 'leisure times.' Both in- and outgoing QSL cards are handled free of charge at SRAL QSL Bureau, all costs are covered by the annual membership fees. No economical help is received from outside. The annual budget is of a class of approximately $12,500 US, the membership fee being 2000 mk ($6) per year. The license itself, being valid for five years, costs 1100 mk ($3.40). In this connection it may be of interest to mention that in Finland every licensed amateur must be member of SRAL. This is a regulation of the Finnish 'FCC' (Post and Telegraph Ministry) and probably due to the control system.

Every day you may hear an OH on the air. Listen to the low end on 7 mc, or to the high end of 14 mc, always OH stations welcome calls from you. Don't ask us to teach you Finnish; it may be a bit difficult to you. Anyway, if you seriously want it, let's start right now: Here are a few words which you may use on the bands to surprise your Finnish friends. Hi!= *terve*!, Cheerio! = *hei*!, cuagn = *nakemiin* (a=.—.—.—), thanks = *kiitos*, many thanks = *kiitoksia*, and finally, when you take a drink and try to say "Prosit!", or "Rendez vous" or something like that, you can as well try to say it in pure Finnish: "hölökykölôkyn!", but you must have something really strong in your glass then, hi. Just a declaration about a and ö letters: a, or "a with two dots" is pronounced like 'a' in the word 'mad', and ö like 'o' in the word 'work'. On CW they are as follows: a = .—.—.—, ö = ———.

Hölökynkölökyn! 73! . . . OH2YV

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W2SKE/MM [Mobile Motel]

Bill Leonard W2SKE

ADDING it up the other day, W2SKE's total operating time in the past two years came to just about 500 hours. But of this total, less than 200 took place from the home QTH. The rest involved temporary locations—more than 20 of them scattered across a dozen states and half a dozen countries. These temporary set-ups provided more fun and more memories than conventional hamming, perhaps because they offered something of a challenge. They meant not only operating, but 'getting on the air', as well. And as every ham knows, *getting on* the air is usually more fun than *being on* the air.

W2SKE operated from a hotel in the Chicago loop, from another in the Dominican Republic, from a fishing camp in Canada, summer homes in Long Island and New York State — but most often of all from motels. Motels of all sorts and descriptions and price ranges, motels perched on hills in the quiet country that might have been designed with ham radio in mind, motels dominated by traffic and noisemaking neon signs, motels in Miami and Tallahassee, San Juan and San Isidro, Des Moines and Dubuque, Hanover, New Hampshire and Avon, Connecticut, Boston and Los Angeles. The DX score from these one-or two-or three-night stands runs to something like 50 countries on 10, 15, 20, 40 and 80 SSB, in all countries. But much more important is the fact that with an absolute minimum of fuss and feathers one was able to stay 'in touch' with the gang or the family. A ham who travels as part of his job, or a ham who travels for vacation fun usually has more time for hamming 'away' than 'at home.' That's why motel mobile has meant so much to me. The trick is to make it—no pain, no strain. Here's how.

The requirements for 'motel mobile,' or any type of 'quickie portable' operation are (1) equipment that is small, light, easily packed, rugged and reliable, (2) an antenna system and equipment that combine to provide a station that will 'get out good' (it's just no fun to get on the air with flea power and talk only to flares), and (3) the station that is easy to put up and take down (a half hour or so to get going, and as much to pack up is all the effort a one-day stand is worth, but proportionately more effort can go into a vacation set-up).

In these days of SSB and miniaturization none of the above is difficult. The author is fortunate in having a Collins KWM'-2 as his basic piece of equipment. Though this hunk of gear goes a long way in fulfilling the requirements above, it is by no means essential to 'quickie portable' operation. What *is* essential is a transceiver—or rather, a station that's all of a piece, *one* hunk of gear. No matter how compact the equipment, the process of hooking up a receiver and transmitter after lugging them around in at least two packages makes the whole operation more trouble than it's worth. The real secret in 'motel mobile' is that it *not* be 'more trouble than it's worth.'

So if you're building, build a transceiver, or a transmitter in a receiver cabinet. If you're buying, buy a transceiver.

Weight? If you do your travelling by car, weight's not the factor it is if your motel, hotel or camp is at the end of a plane trip. But, obviously it's just no *fun* lugging a couple of hundred pounds of gear in and out of a car. Besides, it clutters up that motel room. A fifty pound limit for everything, including spares, mike, antennas, etc., is practical.

Assuming then you have fifty or fewer pounds of dynamite. Assume you can unpack it and plug it in the wall within five or ten minutes. The only problem then is the skywire. And here's where experience pays off. The veteran motel mobiler knows that no two motels, like no two women, are exactly alike. He may or may not be able to drive around looking for the Ham's Paradise Motel (TV, Free Baby Sitter, Coax Outlet to 3 element beam in every room). Chances are he'll arrive in the gathering dusk by car, or taxi from the airport, and have about twenty minutes to case the joint and rig a skywire before the XYL and darkness descend. He must, therefore, be prepared! I always carry the following (in addition to a small, basic tool kit):

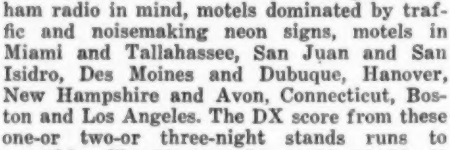

Fig. 2. The quickie triband doublet.

A 500 foot spool of wire (#20 or 22 enamel or bare copper).

A pre-fabbed 20-meter dipole, with small egg insulator at the ends, a small egg insulator in the middle, and 50-100 feet of RG58 U attached.

A small L-match unit (see later text).

A pocket compass.

4 *small* insulators.

1 roll of electrical tape.

50 feet of thin nylon rope or clothesline.

This combination is guaranteeed to get you on the air on at least 20 meters, and probably on all bands in very short order from any motel and from practically any *resort* hotel. For a mid-city hotel I have used the Mosley Tote-tenna with very good results.

Anyway, let's assume you arrive at Paradise Motel. Rule #1 is— case the QTH *before* asking for your room. Behind almost every motel there's a field. At the far end of almost every field there's a tree, a fence, or at least a bush. Try to get a room facing the field (second story if it's a two story motel). Visualize a long wire streaming from this room to that 'hook.' There may be several rooms in a row that 'qualify.' Ask for one of them. If there's no field or wide open space, chances are almost 100% there'll be a light stanchion, or telephone pole nearby. Get a room with clear line of sight to one or more of these supports.

What you have in mind—and what you'll be able to rig in almost no time in almost all motel QTHs is a *thin, random length wire stretched as far as possible, preferably in a favored direction.* Any wire 110 or more feet long at any height will, when matched, work on any and all bands from 10 to 80. The longer the better and the easier to match. Also—the longer the more directional, and the higher the band the more the wire will tend to fire off the ends of the wire.

The important thing—forget about pruning, measuring, or getting a 'resonant' hunk of wire. Practical considerations come first—run it out 'thataway' and let it go at that. Don't be upset if your hunk of wire averages only 6 feet off the ground. Just get it as high as you can. Use the hunk of clothesline or nylon line to help you get over the top of a tree limb. Hook the near (or motel) end to a nail, balcony or what have you near your room (through an insulator, of course). Run the lead-in through door or window sash into the motel room. Wrap the section of wire that passes close to the window or door jamb with plastic tape.

A few motels do not come equipped with built-in fields or woods. In that case forget about everything but 20 meters. String your readi-built dipole between two light stanchions, two palm trees, two balconies, or two blondes.

One other trick some of the motel mobile gang uses. Even those who don't go to the trouble of putting a mobile in their car will

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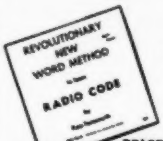

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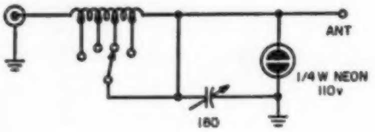
install a ham antenna on the family buggy. Then, when sack-down time comes, they simply run coax to the car antenna and away they go.

The random length of long wire across the open field is best. On the higher frequencies it exhibits real gain in favored directions. A length between 180 and 270 feet is ideal.

Some sort of simple coupler-matching device is almost always necessary in feeding this long wire into a pi-network final. It's probably a mistake to call this device an antenna tuner—it's simply an L-network for matching the relatively high impedance of the end-fed antenna down to the 52 ohm pi final. If all hams used long wires, pi networks could simply be designed to accommodate higher impedance ranges.

I have always used the Globematcher Jr. AT-3, a tiny little package with a neon bulb loading indicator and two controls. Proper loading on the final, coupled with maximum soup in the neon bulb indicates proper tuning.

If you want to build your own, the matcher looks like this:



The coil is a one inch diameter Miniductor, 25 turns with 5 taps at 2, 5, 10, 20 and 25 turns.

One other antenna has been used with success when operation above 20 meters was not desired. It is for use at locations where a long wire is not practicable. This is about the simplest tri-bander we know of. Take a 33 foot piece of twin lead, tie the ends together and attach two small insulators. Cut the twin lead wires at the center, insert insulators, and attach RG-58/U. Cut one wire 8 ft. 2 inches each side of center and pull off enough of the *outer*wire to reach up the half inch or so to the *top* wire, to which it is fastened.

Just one more step. Cut two 11 ft. 2 inch sections of insulated bell wire and lay them along the middle of the twin lead, soldering to the coax at the center, and securing them along the length of the twin lead every 18 inches or less with electrical tape. Reinforce the center section.

A low swr is obtainable on 10, 15 and 20 this way. Build and prune and tune *before* you set it out.

In summary . . . modern motels and modern ham radio make it possible to get on the air fast and effectively, and get *off* the air and ready to move on while the XYL is packing the unimportant things, like clothes.

. . . W2SKE

POSITION OPEN

Many people spend all of their lifetimes not working for ham radio magazines. This is a terrible waste. If our country is to really prosper we have to cut waste to the bone and trim the fat. Help America to prosper, work for a ham magazine. Perhaps you are worried that you do not have the proper qualifications to apply for such a position. Please check the following application blank and send it in immediately, together with the customary $3.50 job application processing fee. Your duties as a staff worker on the magazine will be to read each issue carefully, ignoring the gross technical mistakes that abound and to talk as many friends as possible into subscribing. A certain amount of time should be spent inducing advertisers to make more use of the 73 pages. Should these duties seem a bit harsh, we have a few supervisory positions open; however, the application fee for these is $6.50.

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73 Magazine
1379 EAST 15th STREET,
BROOKLYN 30, N. Y.

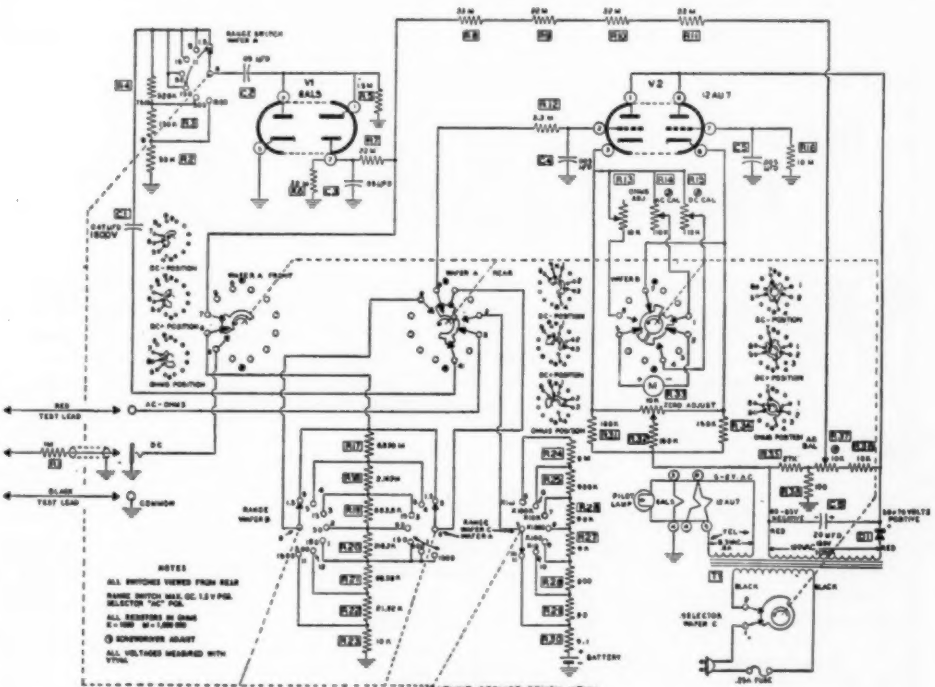
Donald A. Smith W3UZN
Associate Editor

73 Builds and Tests the Heathkit IM-10 VTVM

HEATH's new VTVM, though not strictly a piece of ham gear, none-the-less is equipment that no ham should be without. It's almost impossible to check out or repair a piece of gear without a good, reliable, VTVM.

The IM-10 has a number of features over its predecessor, the V7A. One of the most important, is the new 6" meter which really spreads out the scales. To make its use even more convenient, the scales are color coded. Zero and Ohms adjusts are thumb adjustments instead of knobs. Two new low ac scales have been added for more accurate measurement of low ac voltages. No printed circuit board is used in the IM-10, as it is in the V7A. 1% precision resistors are used as multipliers and the 6", 200 microampere meter has a full scale accuracy of 2%.

A dual triode, 12AU7 tube is used in a balanced-bridge circuit, with the meter reading any imbalance. With no voltage input to the 12AU7, as would be the case when not actually measuring a voltage, each section of the tube will draw the same current. The meter, which


V1
6AL5
V2
12AU7
RED TEST LEAD
AC-OHMS
DC
BLACK TEST LEAD
COMMON
RANGE SWITCH WAFER A
WAFER A FRONT
WAFER A REAR
WAFER B
DC+ POSITION
DC- POSITION
OHMS POSITION
RANGE WAFER B
RANGE WAFER C WAFER A
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6AL5
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ALL VOLTAGES MEASURED WITH VTVM.

HEATHKIT SERVICE BENCH VTVM
MODEL IM-10

is connected between the two cathodes, can not indicate any reading, as the potential of each cathode is the same. When a voltage is applied to one of triodes, one half of the tube will draw more current than the other, causing a difference of potential to exist between the two cathodes. In this case, current will flow through the meter because of this difference in potential or unbalance and the needle will indicate the amount of voltage in the circuit being measured. A zero adjust control is pro-

Heathkit VTVM....IM-10

Weight: 5 lbs
Size: 6½" x 9½" x 5" deep
Power: 105-125 vac 50/60 cy
Ohmmeter Battery: 1.5 v "C"
DC Ranges: 1.5, 5, 15, 50, 150, 500, 1500
AC Ranges: Same as DC
Ohmmeter: 1000 ohms (10 ohms center scale)
Multiplier: X10, X100, X1K, X10K, X100K, X1M
Construction Time: 7 hours
DC Input Impedance: 11 megohms
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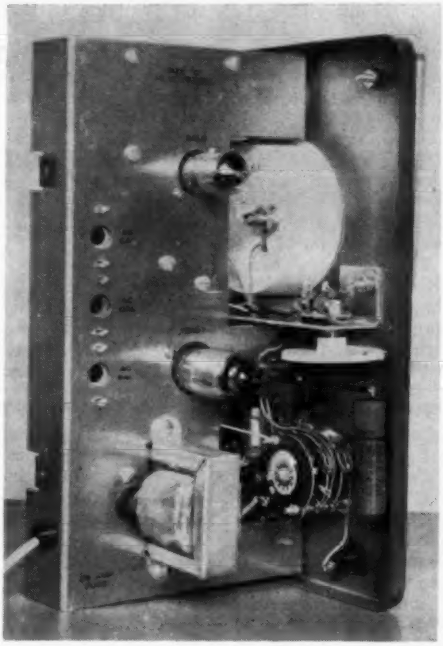
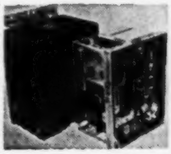


vided to balance the current flow through one half of the tube (no voltage being measured), so that both triode currents will be the same.

Of course not all voltages between zero and 1500 volts can be applied to the grid of one of the triodes, so multiplier resistors are used to extend the basic voltage range up to 1500 volts. These multiplier resistors are 1% precision resistors, as any inaccuracy in these resistors would be reflected in the voltage read on the meter and hence affect the over-all accuracy of the instrument.

On ac, operation is basically the same, except that a 6AL5 is used in a half-wave voltage doubler circuit and ac to be measured is connected to it. When the ac voltage being measured is greater than 150 vac, multiplier resistors are switched in (by the range selector switch), to keep the input to the 6AL5 with-in its rating. The output (dc) of the 6AL5 is proportional to the applied ac voltage and is connected by the function switch to the dc multiplier section. Here the voltage is handled in the same manner as when the instrument is being used on dc.

The electronic Ohmmeter section of the VTVM uses a 1.5 volt battery connected in series with multiplier resistors as well as the resistance to be measured. How much battery voltage fed to the 12AU7 tube depends on the ratio between the resistance to be measured and the multiplier resistance of the ohmmeter section. Though the ohmmeter section does have a battery, the instrument must still be connected to the ac line and turned on, so



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RTTY Handbook

HAM-RTTY
SPACE

Since we have a new RTTY Handbook in preparation it is only natural that I should have quite an interest in the recent RTTY book put out by CQ and written by Byron Kretzman. I have to admit that they have done a nice job of publication . . . good paper, nice type. I am somewhat disappointed in the content. A great deal of the book seems to be lifted bodily out of the book that Byron and I put together back in 1956. Many of the photographs are the very ones that I took with my old Pony Premo #5 camera and several of the diagrams are the same ones that I originally drafted for my column in CQ back in 1952. It is nostalgic to read all of my own words again, lifted out of the old RTTY columns of eight to ten years ago. Though I have been relatively inactive in RTTY since becoming an editor, it is nice to know that I am still considered the authority for the field. Ha.

Work on *our* handbook has taken a lot longer than Byron's modified reprint of my old book. I've been out there with my new Rolli taking pictures of all my old and new TT gear. It is quite a job rounding up information on all the newer equipment and publishing an up-to-date handbook. I think you'll like the result. It has none of that text-bookish approach. It tells you the facts about what gear is best and what to stay away from. It tells you where to get the equipment. It tells you how to hook it up and how to use it. There are several types of converters, some with complete construction details. There are instructions on frequency shifting most commercial rigs. This is a practical book. Though the book was largely assembled by Fred DeMotte W4RWM, you'll find my light touch everywhere you look. Y'all better send in your order right now. Hear? $3, not $3.95.

. . . wayne

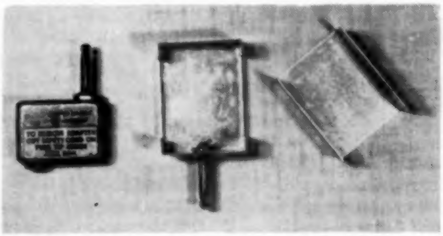
that supply voltage will be available to the 12AU7 tube.

Filament and B+ voltages are provided by an AC power supply and selenium-rectifier. A ¼ amp fuse is placed in the primary of the power transformer to protect the instrument. Calibration controls consist of AC balance, Ohms adjust, AC calibrate and DC calibrate. The meter can not be burned out in the circuit which is used, but it can be moved to the right so rapidly by incorrect settings so that the needle could be bent.

There is more than ample room in the chassis for all parts and wiring, which greatly simplifies building for the inexperienced. The manual is very complete, not only in the construction and calibration of the instrument, but also in explaining the advantages and uses of the VTVM over a VOM.

On any instrument which will be used to repair or adjust other equipment, plenty of time should be allowed for the building, testing and adjustment of the kit. If you can't trust your instruments, you really are in bad shape! No difficulties were found with the IM-10 and calibration was a snap. No special test equipment is required to do the job *properly*. I think you will agree when you finish building it, that it will be used more than any other piece of test equipment in the shack. With its large 6" meter, you can even read the scales at 4 a.m., blood shot eye-balls and all! . . . **W3UZN**

Chassis Mounted Phone Plug



An occasional requirement exists for a chassis mounted phone plug. Construction of station accessory items is often simplified if they can plug directly into the equipment without the use of cords.

The MC-385, high to low impedance headset adaptor is still available on the surplus market at give away prices. Certain models of this unit have a phone plug which is secured to the case with a standard ⅜" nut.

The plug is easily removed and can be installed as required. The photograph shows the adaptor, as supplied, and one application of the plug.

. . . W4WKM

Photo Credit: Morgan S. Gassman, Jr.

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Commercial Notes

Irving Electronics surprised us with their new Hiverter and Preverters. Up 'til now Pappy has been taking it sort of easy down there in San Antonio turning out a whole series of printed circuit boards and kits. He has circuit boards available for almost every piece of ham gear ever written up using a board. Now, all of a sudden, he is making complete units. The Preverters are one band (six or two) transistorized preamps operating from 12 volts. These are obviously designed for mobile use and should meet a need for something to hop up the front ends of most of the commercial transceivers. The Hiverter is the answer to SSB on six meters. I know from my mail that a lot of fellows want to try SSB up on six, but not much has been available commercially to help them out. I've been after several manufacturers to get something out for this, so I'm happy to see it available.

The last time I decided to make a maximum effort to beat the ignition noise gremlins I found it a major job to locate the needed components. If it is difficult to do it here in New York where we are supposed to be able to find anything we need, I can imagine the problem a fellow would face out away from everything. Sprague has an answer to the difficulty, their new Suppressikit Type SK-1. This nets for $17.85 and is supposed to suppress everything below 400 mc! It works with either six or twelve volt systems. The kit comes with complete instructions and everything is ready to use.

While on the subject of cars. . . . I discovered that Bill Slep (ad page 85) not only does a lot of business with surplus down there in Florida, but has his finger in this electronic ignition deal too. He will have kits available for this before long. I'm looking forward to trying one on my Porsche. I'd better not tell the factory, they'd probably take a dim view of it. It looks good to me though and will be very simple to install. Bill seems to have quite a new idea there with his taking of surplus gear in trade for new ham gear.

(W2NSD from page 4)

quests for information. Whenever you write to a company that does advertise you might thank them for helping to bring you the magazine . . . and encourage non-advertisers to rework their ad budget to include 73. You'll notice that a couple of the major manufacturers in the ham field are terribly conspicuous by their absence. I don't know whether this is because they hate me in particular or whether they don't want to have their products associated with such informality as we sport here. It is probably more the former for I am basically pretty rotten, as should be obvious in my editorials by now.

Your local parts distributor could probably stand a little pressure too. This fellow should have 73 on his counter, carry a goodly stock of our HAM-TV book and our INDEX TO SURPLUS book. If he has enough ham trade to carry magazines and books, then he should be advertising a bit too. Maybe he isn't big enough for a full page, but how about one of those 2"ads? They are only a little over $25 a month.

I realize that these are a lot of things that I should be doing myself, but by the time Virginia and I get through sorting out subscriptions, reading articles, getting the magazine ready, calling advertisers for their promised ads, and preparing books, there isn't any time left to do anything else. Good grief, what will happen to everything while we're away for a month buzzing around Europe? We'll never catch up.

Reciprocation Again

Every time I talk to a radio club I ask for a show of hands on who has written to their Congressman about the Senate Bill 2361. So far I have seen one or two hands, and I get around to quite a few clubs. You can even add in a couple of conventions that I have addressed without getting much more of a response. This is very discouraging. Perhaps I am over emotional about this, but I feel that our showing on this matter is a key to our whole attitude toward the hobby. A lot of fellows are participating in ham radio without giving the hobby any personal support. They seem to feel that once they've subscribed to QST they have their own obligation out of the way.

If we allow this bill to die in committee

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without any attempt to administer artificial respiration then we deserve everything that I believe will happen to us as a result. First and foremost we will find that the indignation of the DX hams is high when we have gone so far as to have a bill sponsored and then permitted it to die in committee. Almost every foreign amateur in the world feels a personal interest in this insignificant piece of legislation. Under our present rules no foreign amateur can get permission to operate while visiting the U. S. Senate Bill 2361 will change this to permit the F. C. C. to permit foreign licensed amateurs visiting the U. S. to operate, providing there is no possible question of security.

In many foreign countries quite a few of the amateurs are high in the government or leaders in business. Many of them swing a lot of weight. At international conferences on radio we find that an extraordinary number of the delegates turn out to be amateurs. These are the chaps that will be deciding in a couple of years just how the amateur bands are going to be re-allocated. These are the chaps who have occasion to visit the U. S. frequently and are prohibited from getting on the air during their visits to talk with us as locals and to talk home to friends.

If I tell you what I think may well happen at the next Geneva Conference you will dismiss me as an alarmist and heretic. Other magazines will editorialize on my "scare techniques" and so on. I think I know what I'm talking about and I have yet to meet one responsible ham who is in touch with current events who thinks any differently than I. The last conference taught me a lot, and little of it had any soothing effect on me as far as the brightness of our future is concerned. I feel that any amateur who has an interest in his hobby has a duty to write a letter to his Congressman asking him to support Senate Bill 2361 and help get it out of committee.

If we should fail in this effort then we will be branded as ineffectual and we can be walked over by every other interest who covets our frequencies. Where will such a demonstration of weakness get us when the Citizens Banders get a lobby in gear asking for more CB channels? These fellows already outnumber us by two-to-one. We lost Eleven meters to them even when we had them outnumbered. If you don't start writing we're sitting ducks.

Speaking of lobbies, how come we don't have a small group (even one man) down in Washington on a matter as vital as this? As I have said before, even one man could probably get this bill over the rough spots. If no amateur organization has a man free for the job, what about our manufacturers? Don't you fellows care what happens to the ham market in three or four years? You're selling about $30 million worth of gear to hams a year, put a few hundred into keeping us going even if we're too busy talking on the air to drop a line in our own behalf. Have your rep in the Washington area check into things and push a little where it will help.

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End of tirade.

Books & Booklets

Some time ago I editorialized about our publishing some small books and booklets. The response was rather good to this suggestion and we are now in the process of publishing the first of these. Our HAM-TV book doesn't count on this because we started work on that over a year ago. One of our first books under the new plan is the Index To Surplus by W4WKM. This is a prodigious effort by Roy and lists every surplus conversion article ever published in any of the popular radio magazines or con-

(W2NSD from page 87)

version manuals, along with a brief description of the conversion.

This book just came back from the printer and it is one I'm proud of. Everything went well with it . . . the print job is first class, the cover looks nice, and we have found no mistakes in it. This will be available through 73 directly, from Radio Bookshop, and should start appearing on the counters of the parts distributors soon. In particular I expect that surplus dealers will be wanting to sell this gem.

Fred DeMotte W4RWM of the Florida RTTY Society is putting the finishing touches on the new RTTY Handbook. Fred wanted to finish it earlier, but I held him up in order to get in some last minute commercial equipment. I also wanted to wait until CQ brought out their recently announced RTTY book to make sure that we covered everything that they missed. I'm happy to report, after seeing the CQ effort, that our book is much less textbookish and is written from the practical application aspect rather than the heavy theory angle. I suspect that most TT devotees will invest in both in order to have as full a library as possible.

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Carole Hoover K9AMD and I talked over the booklet idea out at the Springfield (Ill.) convention last year (where my transistor radio was stolen from my room at the St. Nicholas Hotel). Carole followed my suggestions and has done a magnificent job of preparing a booklet on ham radio clubs. She went into a lot of research, writing to dozens of ham clubs and interviewing hundreds of ham club officers to find out what aspects were important to the survival of a ham club. Her booklet, well illustrated, is now available under the title, "The Care and Feeding of a Ham Club." This booklet is not only interesting reading for everyone, but will be invaluable to all hams who want to help their own club grow and prosper.

K8LFI, one of our regular authors, sent in a manuscript recently that was much too long to publish in 73. I suggested that we put it out as a booklet and Bill went along with the idea. This one is called, "Simplified Math for the Ham Shack." This is the best math article I've ever seen and it makes the whole process quite simple. I know that a lot of people have a great fear of math. This is a shame, for once brought out of the school book and given the breath of life the subject is simple and interesting. Bill is a wonderful explainer and he leads you gently from one step to the next, covering the whole subject with expert finesse.

What with trying to get 73 ahead enough to let us go to Europe for the month of April, it is incredible that we should also be able to produce even more booklets. WøOPA sent in a piece on the "Mickey Miker" which just had to be published. Again it was too long to print in 73 unless we chopped the daylights out of it. This is now a little eight page booklet. Harvey gives exhaustive details on the building of this fine piece of test equipment which will measure capacity right down to the fraction of a mmfd.

K8BYN sent in a fine piece on coils. I've long felt that there was a need for a basic series of booklets on radio. This one does a wonderful job of explaining about all the various types of coils that are used in radio construction and is magnificently illustrated.

As more book and booklet manuscripts come in we'll be publishing more booklets. I am quite sure that we are giving the best deal by a very

(Turn to page 90)

TEST EQUIPMENT

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National HRO	$59.00
Central Electronics #20-A with VFO and QT-1	$195.00
Gonset Communicator IV for 6 Meter	$245.00
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(W2NSD from page 88)

wide margin to all authors of books. For that matter we are giving the best deal to all authors in 73 too.

Look over the list of booklets and stint not.

Write

If you've been reading the editorials at all it should come as no surprise that Virginia and I are leaving for Europe on April first via Lufthansa chartered jet. The Porsche Club of America is sponsoring the trip. As you may know, a charter flight costs less than half of the regular tourist class fare. We will arrive in Stuttgart on the second and be driven to Solitude Castle where all of the new Porsches ordered by the club members will be spread out on the huge lawn. Among them will be my old 1958 Porsche Speedster which I shipped over in January to have reconditioned.

I was all for ordering one of the nice new model Porsches, but Virginia pointed out that we are much too close to pauperism to even consider putting a down payment on a new car. Practical gal.

You're probably getting pretty tired of hearing about Porsches all the time, perhaps I'd better explain. All Porsche owners are absolutely certain that the Porsche is the finest car in the world at any price. Dr. Porsche was a fanastic genius and is responsible for many of the best features of todays cars. He designed the little VW. He thought up the flat opposed piston air cooled engine which makes the VW (and Porsche) so unbeatable. He invented torsion bar suspension, synchromesh transmission, and was one of the first designers to streamline cars. There are whole books written about the amazing works of this man. His masterpiece is the Porsche car. If you follow sports car racing you know what successes Porsche has had.

Several European amateurs have written and I've set up a fast schedule of talks during my trip. The exact route is: Stuttgart, Munich, Innesbruck, Venice, Florence, Pisa, Genoa, Milan, Geneva, Bern, Luzen, Zurich, Frieburg, Paris, Luxembourg, Heidelberg, Darmstadt, Frankfurt, Berlin, Frankfurt, Wiesbaden, Nurburgring, Bitburg, Koln, Mulheim, Arnhem, Rotterdam, Amsterdam, Hamburg, and New York. It sure would be fun to get a card or letter during the trip from any of you that care to write. You can write to me in care of American Express, Paris, France where I will pick up all mail on the 14th of April, or American Express, Berlin, Germany on the 19th. Airmail letters take about four days, so leave time. Airmail is 15¢ to Europe, but I'm not worth it. May be a QSL, at least?

April Last Year

The April 1961 issue of 73 was quite an issue. We still have a few left in case there was something you missed in it. The most interesting article (according to reader votes) was K8BYN's Six Meter Nuvistor Converter. This unit used two 6CW4's in cascode and resulted in a very low noise figure circuit. K8ERV came up with a dummy "next stage" device, a continuous tuning link coupled absorption wavemeter with a loaded and metered rf indicator. W4WKM has an article on how to protect silicon rectifiers in case of a shorted capacitor. K4ZGM's Let's Modulate, Not Crepitate explores Heising modulation . . . rather successfully. Jim Kyle K5JKX has a new noise limiter circuit for us. Many readers

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have written in telling us how well this one works and recommending it. W4WQT writes about the importance of calibration. W6VVZ's PP 304TL gallon final may not be new, but it does show us how to get maximum power economically. K2SJN comes up with all of the answers TVI committee needs to handle the difficult cases. W9HOV (Gain, Inc.) presents a chart of the lengths of ½ wave, ½ wave coax, ¼ wave coax and 4½ waves for the different ham bands. K8HDR came up with a clever method of getting a lot more audio out of the Command Receivers KL7DLC sold a lot of the April issues with his transistorized 40 watt modulator. Great for mobile operation. W3UZN tested the Heath Twoer for us. Bill Ashby K2TKN had a fine article on noise suppression. Our big technical article for this month is on *if* selectivity and it covers ceramic filters, Collins filters, crystal filters, lattice filters, Q-multipliers, L-C filters, Q-5'ers, etc. To cap the whole works we have an article on how to write for 73 and get rich beyond your wildest dreams. While they last they are 50¢ each.

Reader

Shortly after the March issue of 73 was published I got a frantic phone call from S.E.G. Sales. It seems that Sam has thousands of those FL-8 and FL-5 filters on hand and is willing to force himself to part with them at a low figure ($2.49). I believe you'll find more details on this situation back on page 94. In checking the fantastically complete list compiled by W4WKM and published by us under the title of Index to Surplus ($1.50) I find nine other references to FL-8 and FL-5 articles. The most important is the one I published in CQ in November 1957 wherein you can achieve almost unbelievable selectivity with cascoded FL-8's.

Oh Rally?

A letter from KZ5SW Ted Wilds asks, "Where . . . was the rig in your Porsche? I didn't see it in the photo in Foreign Car Guide. There was a lot of other expensive equipment." Look closely Ted, down under the dash is a Transcon-6! This makes the dozenth magazine to print this picture of the most accessoried sports car ever seen. This is the cockpit of my 1958 Porsche Speedster, all duded up for rallying.

What's a rally? Where've you been! A rally is a completely non-ham radio event (which has no business in 73, except that it is an enthusiasm of the editor and sometimes you have to take the bad with the good) primarily of interest to sports car addicts. Most sports car clubs put on several rallies a year, and they are about the only source of rallies. In a rally you have a driver and navigator. You are given a set of instructions and started out at one minute intervals. The object is to follow the instructions as closely as possible, keeping on the roads specified and driving at

2 METER STATION $27.50!!

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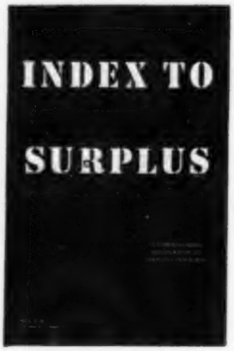
INDEX TO SURPLUS



Roy Pafenberg W4WKM has accomplished a major effort in this compilation. It lists every known surplus conversion article, giving a capsule rundown on the conversion accomplished and the magazine in which it was published. If you do any surplus conversion work this book can save you a lot of time by telling you exactly what conversions have already been published. 64 pages packed with information.

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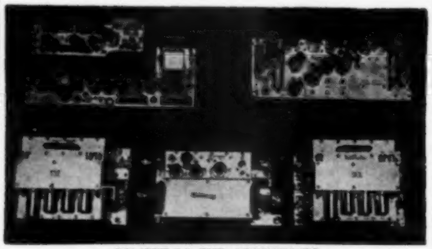

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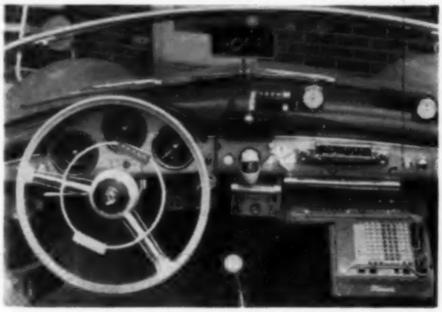
(W2NSD from page 91)

the specified speeds. Every so often you will come across a checkpoint where you are timed. They know exactly what time you should pass the point and you lose points for every second early or late there. It takes great attention to detail to consistently win these events.

Many hams have been attracted to rallying. It is a rare Sunday rally in this area that does not see at least a half a dozen hams participating. Harold Winston W2DIR, who started rallying about two years ago, is now president of the Town & Country Sports Car Club. This is remarkable when you consider that he drives a Desoto! I notice that old friend Bob Schoening WØTKX is high on the SCCA rally list for 1961. Porsche driver. Most of the gang up at ARRL HQ are rallying these days and now and then one of them ventures down this way to compete.



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You've got a lot of writing ahead, you'd better get started. Write our advertisers, your senator, CQ for my slides, and don't forget to drop me a note in Paris or Berlin.

Wayne

FL-8
FL-5F
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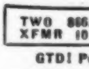

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6AT6	2/$1	25A6	1.19	5654	1.20
6AU6	.79	25A7	2.19	5656	4.25
6B8	1.35	25C5	.81	5663	1.15
6BA6	.59	25L6	.72	5670	.90
6BE6	.59	25T	4.00	5686	1.75
6BG6	1.49	25Z5	.72	5687	1.15
6BH6	.79	25Z6	.75	5691	4.70
6BJ6	.72	26A7	3.69	5725	1.95

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6BK7	.99	FG27	8.28	5732	2.00
6BL7	1.35	HV27	19.39	5736	85.00
6BN4	.69	28D7	.89	5749	1.95
6BN6	1.08	FG33	15.00	5750	2.75
6BN7	1.99	EL34	3.49	5751	1.25
6BQ6	1.19	35A5	.69	5814	1.20
6BQ7	.99	35L6	.59	5879	1.20
6BX7	1.11	35T	4.49	5894	$12.00
6BY5	1.19	35Z5	1.25	No See—Write!	
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280/400	350/500	420/600	490/700
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rms/piv	rms/piv	rms/piv	rms/piv
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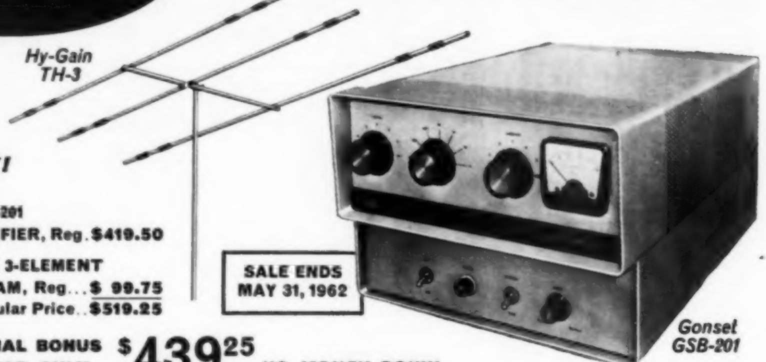

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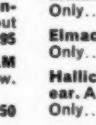

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